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SPECIAL ISSUE

DISEASES OF SWINE

Assembled by A. T. Kinsley

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PUBLISHER'S NOTE—For lack of space, we are compelled to postpone the publication of several articles prepared for this Special Issue, including discussions of Swine Balantidiasis, by J. D. Ray; Anthrax in Swine, by L. E. Day; Vesicular Exanthema, by Carl E. Wicktor and B. B. Coale; Rickets in Swine, by C. E. Salsbery; Restraint of Swine, by D. D. Baker; Infectious Necrotic Enteritis, by A. T. Kinsley; and discussions of internal and external parasites, protozoal diseases, nutrition, etc.

The list of diseases for which trichinosis has been mistaken is a very long one.

Careful surveys indicate that one person in every seven in America has at some time suffered from trichinosis.—*J. S. Cates.*

A skin test has been discovered which should simplify the diagnosis of trichinosis. The antigen is made from trichinae which have been removed from their cysts by digestion and ground up to make a 1:10,000 suspension.

Two facts stand out, according to Dr. Maurice C. Hall: first, the United States, apparently, has the greatest trichina problem of any nation of the world; second, little is being done about this major health menace.

The conclusion that the chief manner of distribution of *Trichinella spiralis* is hematogenous is considered confirmed by the presence of larvae in the blood and lungs of infected animals, and by experimental injection of mature trichinae into the blood vessels.

Trichinosis is much more prevalent than is usually supposed. It is estimated from post-mortem examination that 20% of the people in the north-eastern states of the United States are infected, although not likely showing symptoms which are recognisable.

Examination of muscle samples taken from the diaphragms of 10,000 hogs representing the average run of the various slaughterhouses of Chicago revealed 50 cases, or 0.5%, of trichinosis. In one case there were about 1,500,000 trichinae per pound of flesh.

Studies on trichinae carried out to obtain information on the incidence of these worms in garbage-fed hogs as compared with that in grain-fed hogs disclosed an incidence of trichinae in garbage-fed hogs about five times as great as that in the grain-fed hogs.

Ground *crotalaria spectabilis* seeds, fed to five hogs in 2gm daily doses, and to ten hogs in 0.5gm daily doses, produced fatal results in most cases.

Bureau inspectors, on request, issued certificates to accompany shipments of 10,476,575cc of anti-hog-cholera serum, and of 775,195cc of anti-hog-cholera virus to foreign countries, during the fiscal year 1935-36. The total quantity of anti-hog-cholera serum reported to the Bureau of Animal Industry as having been exported aggregated 11,663,575cc.

Licensed establishments under the supervision of the Bureau of Animal Industry produced the following quantities of biologics during the fiscal year 1935-36: anti-hog-cholera serum 527,778,474cc; anti-hog-cholera virus (simultaneous) 55,702,391cc; anti-hog-cholera virus (hyperimmunizing) 114,234,080cc; anti-hog-cholera virus(inoculating) 605,245cc; enteritis serum porcine) 7,150 doses; erysipelas serum (porcine) 288,212 doses; mixed infection serum (porcine) 2,397 doses; enteritis bacterin (porcine) 268,751 doses; hemorrhagic-septicemia bacterin (porcine) 32,306 doses; mixed bacterin (porcine) 1,559,851 doses; erysipelas vaccine (porcine) 340,916 doses (for export only).

During the fiscal year 1935-36 the following quantities of biological products were destroyed, under the direction of the Bureau of Animal Industry, U. S. Department of Agriculture, as unfit for use: anti-hog-cholera serum from animals found diseased 1,488,056cc; anti-hog cholera serum contaminated and otherwise unfit 1,051,292cc; hyperimmunizing hog-cholera virus from animals found diseased 3,763,755cc; hyperimmunizing hog-cholera virus contaminated and otherwise unfit 290,152cc; simultaneous hog-cholera virus from animals found diseased 1,259,055cc; simultaneous hog-cholera virus contaminated and otherwise unfit 695,950cc. Most of these products were rejected and destroyed in the course of preparation, but some were recalled from the market for destruction.

A nursing sow, weighing about 300 to 400 pounds, will yield on an average of from eight to ten pounds of milk a day, during a nursing period of eight weeks.

The eggs and larvae of the common nodular worm are resistant to subzero temperatures, the survival time of the larvae being far greater than that of the eggs.

Much of the damage produced by nodular worms, as evidenced by retarded growth and lack of condition, can be avoided despite the presence of the infestation, by the administration of solutions of copper sulphate and ferric sulphate to the parasitized pigs.

Studies on the common nodular worm of swine show that the larvae of this parasite are long lived and markedly resistant to environmental influences. Larvae exposed in July, 1935, on bare plots and on plots which had been seeded to grass were still alive in April, 1936, nine months after the beginning of the exposure.

In 1932, Cholera cost Canada $175.00 per million hogs. During the same year it cost the U. S. $500,000.00 per million hogs. Canada uses the slaughter method for the control of cholera. In the United States, we place the virus unrestrictedly in the hands of Tom, Dick and Harry.

Polydactylism consisting of an extra toe on the front feet occured in 13 of 125 Duroc Jersey pigs at the California Experiment Station. These pigs were the progeny of closely related parents. The anomaly occured in both males and females in about equal proportion.—E. H. Hughes, *Journal Heredity*, 1935.

It has been claimed that by intracerebral inocculation, hog cholera can be serially propagated in guinea-pigs, though in a form that is non-pathogenic for swine. In the opinion of the investigators of the Pathological Division of the Bureau of Animal Industry, proof of growth of the virus in guinea-pigs is inadequate.

Anaplasma taiwanesis is a new species of anaplasma found in swine in Taiwan, Japan.

Tubercle bacteria, apparently of the bovine type, caused a 100% death rate in a herd of twelve sows and 68 pigs.

In experiments with swine conducted in Iowa, intestinal emphysema was found associated with feeding polished rice.

Studies by Shope indicate that in pseudorabies in swine the nose serves as the portal for the entrance and exit of the virus.

Several attempts to cultivate the virus of hog cholera in the chorio-allantoic membrane of chick embryos were entirely unsuccessful.

When using a leaky syringe the fact should not be overlooked that 1/50,000cc of virus is sufficient to produce cholera in a susceptible shote.

Preliminary studies on the possibility of basing a diagnostic test on the diminished clotting power of the blood from pigs affected with hog cholera were not encouraging.

A disease which in swine herds in the region of Mateur, Tunisia, has resulted in 30% of the animals dying has been found to be caused by a new fluke, named *Harmostomum suis*.

Under the name of *Brachylaemus suis*, Balozet described a new fluke which has caused a large loss in pigs aged two to four months in the region of Bizerte, Tunisia.

Results of studies of the Pathological Division of the Bureau of Animal Industry indicate that the definite separation of the *Erysipelothrix rhusiopathiae* into the rough and smooth types is an important factor in the production of a reliable and stable swine erysipelas antigen.

Swine Herd Examination

By ASHE LOCKHART,
Kansas City, Missouri

History

The ever-increasing complications in swine diseases make it necessary that those interested in the diagnosis of diseases of swine employ every possible means to arrive at an accurate diagnosis. Clinical examination of swine herds should begin with careful consideration of the history, not only of the herd and the premises, but of swine diseases in the community. Certain communities are known to harbor certain types of infection, and the presence of a specific disease, as for instance cholera, in a community must be given consideration. Some premises are known to be periodic or constant sources of some of the ailments which affect swine, and careful inquiry into premises and community history often enables the practitioner to avoid an error in diagnosis, or enables him to arrive at a diagnosis more promptly than when this history is not obtained.

The history of an individual herd should be ascertained as fully as possible and should include information as to whether the herd has been immunized against cholera and the length of time difficulty has been experienced in the herd. Sanitary conditions of the premises are to be carefully noted and an examination of the feeds available and an inquiry into feeding methods should be made. Methods of providing salt are frequently at fault, and on some premises the possibility of swine obtaining poisonous amounts of salt or other injurious substances is much greater than on other premises. Time spent in collecting the foregoing information is never wasted, because it frequently furnishes a guide to correct diagnosis which can not be obtained readily in any other way.

Clinical Examination

Having obtained a complete community, premises and herd history, careful examination of individual animals is in order. The general appearance of the herd should be noted. Unthriftiness of the main portion of the herd indicates low resistance and may be due to parasitism, chronic bacterial infections, dietary deficiencies, poor management, etc.

In examining a herd, animals should first be observed while at rest. Then the animals are made to move about, and offered feed. Complete inappetence is associated with few conditions other than cholera. The general appearance, posture assumed, character of gait, etc., of sick animals should be observed carefully. The temperature should be taken of typically sick animals.

Having observed general appearance, appetite, temperature, and other general symptoms, it is in order to consider any special symptoms which may be in evidence. Character of respiration and whether cough is present, and the type of cough, if present, are important factors for study. The presence of diarrhea or constipation, and if diarrhea is present, its character, must be given consideration. Lameness is often present in certain conditions. The character of lameness may furnish an important guide to final diagnosis. Skin discoloration occurs in several diseases, and the character of this discoloration is important. The eyes and nostrils should be examined for discharges. Swelling of the ears, tail or joints frequently indicates sub-acute or chronic swine erysipelas, and sloughing of ears, tail or skin, usually indicates chronic swine erysipelas.

Post Mortem Examination

After thorough ante-mortem examination has been made, it is in order to select suitable subjects for post-mortem examination. In selecting these subjects, it should be borne in mind that when animals have been sick for a considerable period, various complications are apt to have occurred and these sometimes obscure the primary disease. It is therefore important that animals that are typically affected be selected. In case there are any acutely sick animals, the selection of one or more of these is in

order. After necropsy of an acutely sick animal, if there are some which are chronically ill, they also may be made use of for autopsy.

In conducting the necropsy, care should be taken not to spoil or obliterate any lesions that are present, particularly if laboratory aid is to be sought in arriving at a diagnosis. The method of performing the autopsy is important, but may vary greatly with the practice of individual veterinarians. Any method which permits the veterinarian to see all the structures of the body, and to make a careful examination of them, is adequate. Careful notations should be made of all lesions encountered.

Selecting and Shipping Specimens

When specimens are to be sent to a laboratory, care must be exercised to select those which will give the laboratorian an opportunity to be of real assistance to the practitioner. Always it must be borne in mind that the value of laboratory diagnosis is limited by the character of specimens examined. Contaminated or putrefied specimens are of little or no value for diagnostic purposes. The specimens that should be collected for the laboratory vary with conditions encountered. Usually a sample of blood from the heart or from a good clean stick-out wound should be collected in a scrupulously clean bottle and tightly stoppered. If it is desired that filtration and inoculation tests be made to determine the presence or absence of cholera, the sample must be of sufficient size to permit the separation of a reasonable quantity of serum for filtration. Other specimens to be collected depend upon the lesions found. Glands that have not been incised, at least one kidney, the heart and the entire spleen, are the specimens usually selected from which to make a diagnosis.

Such specimens should be packed in a thoroughly clean jar, or other tight container, and ice packed around this jar in a larger container. When any portion of the alimentary tract is sent with the specimens, it should always be placed in a separate container to avoid contamination of the other specimens. Lungs are best placed in a separate container because of the danger of contaminating other specimens. The use of ice or dry ice for packing around the containers of the specimens is always desirable. Any preservative which is added to the specimens interferes with their usefulness in the laboratory.

While it is realized that collecting and shipping of specimens in the above manner is considerable trouble, it should also be realized that most of the failures in laboratory diagnoses are due to the poor quality of the specimens received by the laboratory. When a group of specimens is received at the laboratory without history, symptoms and lesions encountered in the field, the laboratory worker is under a decided handicap, and, therefore, it is essential that a letter should accompany the specimens, giving a complete history, symptoms and lesions of the case in question.

* * * *

Tuberculous Pork

Of 45 million pigs slaughtered in the United States in 1934 and inspected by federal meat inspectors, over five million were tuberculous.[32] The carcasses showing wide-spread lesions and being condemned numbered 40,000. The vast majority of carcasses were passed for consumption after the removal of local lesions. Cultures from the left precrural or right iliac lymph nodes of 101 pigs yielded viable bacilli of the avian type in four cases.

[32] Feldman, W. H. 1936. The recovery of virulent tubercle bacilli from the tissues of swine intended for food. *Jour. Inf. Dis.* 59:43-49.

Diseases of the Joints of Swine

By H. C. H. KERNKAMP, St. Paul, Minn.,
Division of Veterinary Medicine, University of Minnesota

THE joints or articulations, like other parts of the body, are subject to disease and injury. The diseases may be inflammatory or non-inflammatory. Inflammatory diseases of the joints are included under the general heading of arthritis. The non-inflammatory diseases and the conditions resulting from injury are usually designated by terms descriptive of the anatomic parts involved, the existing pathologic process, or the specific etiology. *Arthropathy* is a term which refers to any disease of a joint.

A joint, according to Sisson, "is that anatomic structure which is formed by the union of two or more bones or cartilages by other tissue." From a strictly anatomic and physiologic standpoint, several different kinds of joints are to be found in the body. Some joints are relatively simple while others are quite complex. The more complex joints usually contain cartilaginous and ligamentous elements in their make-up and are surrounded by a fibrous structure, the joint capsule. The joint capsule, because of its synovial secreting inner membrane, is an important part of all joints possessing it.

Inflammatory Diseases of Joints. Arthritis

Arthritis is not an uncommon disease in swine. It may occur as a disease *sui generis* or as a secondary complication to some other disease. Arthritic lesions are often associated with or follow umbilical infections. Not infrequently they occur in connection with acute or chronic general infections. The joints of the limbs seem to be the most frequently affected. The inflammatory process may involve only one joint or it may occur in several joints simultaneously.

From the standpoint of pathology, three or possibly four types of inflammatory changes occur in joints. Thus, a serous type, an exudative type, a suppurative type and a serofibrinous type are recognized. Combinations of two or more of these types sometimes occur. Acute and chronic forms of arthritis are observed.

The Author

The chief causes of arthritis are infection, certain food deficiencies, and trauma. These may act singly or in combination with the ultimate result that inflammatory changes occur in the joint. Of the infectious agents which have been considered as the cause of arthritis, the following list of organisms is representative: *Corynebacterium pyogenes, Streptococcus pyogenes, S. viridans, Staphylococcus aureus, S. albus, Erysipelothrix rhusiopathiae, Brucella abortus, Pseudomonas aeruginosa, Escherichia coli,* and a yeast-like organism. These organisms have been obtained in pure culture from some of the cases examined while in others they occurred as mixed cultures. Cases of arthritis have been studied here and elsewhere from which no organisms could be demonstrated as the probable causative factor, although it seemed reasonable to suspect that some infectious agent was involved.

The manner by which infectious agents gain entrance to the joints is not easily explained in all cases. It is readily seen how bacteria might enter the joint in the case of a puncture wound which extends directly into the joint cavity. It is also easy to understand how, by direct extension, organisms could reach a joint from a cutaneous or subcutaneous wound located near the joint. On the other hand, when the site of infection is located at a relatively great distance from the joint, as for example the umbilicus or the tonsil, then most likely the route of transport is by way of the blood or lymphatic systems. Many times the joints are the only places

where the organisms localize and become active even though no previous injury of the joint had occurred. Infection superimposed upon an injured joint, whether the injury resulted from trauma or from the effects of certain food deficiencies, is a sequence of events which often occurs in this disease. There is some evidence to indicate that some of the organisms referred to above, (*E. rhusiopathiae, C. pyogenes* and

S. viridans), will produce particular types of arthritis. Before this can be definitely established, however, more work on this problem is necessary.

The elements of the diet, which when absent or deficient sometimes cause the development of arthritic lesions, are principally calcium and vitamin D. Phosphorus, while it is another important and essential mineral constituent of the body, is less likely to be involved. The cereal diets usually supplied to swine carry proportionately greater amounts of phosphorus than of calcium, and therefore it is more necessary to supplement them with calcium. When inflammatory changes occur in joints as a result of these deficiencies, they represent cases which have progressed well into a stage of chronicity. Many cases of articular disease occur as a result of calcium and vitamin D deficiencies, but they are not manifest by inflammatory reactions and therefore are not true cases of arthritis. They will be discussed later.

Arthritis produced by trauma can be passed over quickly at this time. The ways in which traumatism can be induced are many, but their effect is much the same. The extent of the trauma usually determines the degree or extent of the inflammatory reaction.

In *serous arthritis* the lesion consists mainly of an abnormal accumulation of serous fluid (or possibly synovial fluid) within the joint capsule. The amount of fluid collecting here may be so great as to cause marked distention of the capsule resulting in a swollen and painful joint. Arthritis of this kind usually develops following traumatic injury (strain, contusion, punctures, etc.). As a general rule serous arthritis involves only a single joint, but two or more joints in one or more limbs may be affected simultaneously.

In cases of *exudative arthritis*, inflammation of the synovial membrane is characterized by congestion, swelling, and the collection of small tags on the surface of the synovial membrane. The more chronic forms reveal the presence of flaky particles in the synovial fluid which cause it to appear turbid. The fibrous layer of the capsule often becomes thickened, and sometimes rather dense masses of fibrous tissue form around the joint. Bacteria, such as streptococci, staphylococci and colon organisms are frequently associated with lesions of this kind. On the other hand, no infectious agents are found in many of the cases.

The type of arthritis most commonly observed is *suppurative arthritis*. One of the characteristic findings in this type is the presence of pus within the joint cavity, in the periarticular tissues or both. It is not uncommon to find cavernous pouches containing cream-like to fluid pus in the tissues surrounding the joint cavity proper. These pouches or fistulous tracts may extend upward or downward from the joint level and involve adjacent bursae and tendon sheaths. As a usual thing the synovial membrane is thickened and covered with granulations. In cases of long standing, degenerative changes occur in the articular cartilages and sometimes in the underlying osseous tissue. In fact, bone changes, typical of osteitis and caries, may develop. The cause of this type of arthritis is principally bacterial.

From time to time during the past quarter century attention has been called to an

articular disease in swine referred to as *polyarthritis.* As the name implies, polyarthritis is an inflammatory disease of joints and affects several joints at the same time. Pigs of all ages are affected. It has been observed in suckling pigs from one to two weeks of age and in mature swine that were two or more years of age. In some herds the condition has occurred sporadically while in others it approached endemic proportions. In some instances a large percentage of the pigs in a single litter are affected, whereas in others it occurs in individual pigs of different litters. Pigs sometimes die with apparently acute and fulminating forms of polyarticular disease, but more often the disease tends toward chronicity.

From the standpoint of etiology, polyarthritis in swine is not specific. Contrary to the views of some workers, a varied group of bacteria have been obtained from typical cases of arthritis occurring in several joints simultaneously. *E. rhusiopathiae,* the causative agent of swine erysipelas, has frequently been described as the cause of polyarthritis. Another organism often encountered and considered a causative factor of this disease is *C. pyogenes. Br. abortus* has been isolated from cases exhibiting inflammatory changes in several joints and streptococci and staphylococci are obtained in many cases. A yeast-like organism, undoubtedly belonging to the group of Blastomycetes, was obtained in culture, and smears were made from the joints of four young pigs (three to seven weeks of age), each exhibiting a suppurative type of multiple arthritis. Three of these pigs came from the same farm, two of which were litter mates. At the present time we are not prepared to say whether the yeast-like organism was the exciting cause. From other typical cases of polyarthritis on this farm, *C. pyogenes,* staphylococci, and coli were isolated and in still others, no organisms were obtained in culture.

The pathologic changes that occur in clinically typical cases of polyarthritis vary considerably. Changes that characterize the exudative and suppurative types of arthritis are most frequently observed. Further investigation may help to correlate more definite types of articular lesions with specific etiologic factors, but at present no such relationship can be definitely asserted.

The symptoms of arthritis are not difficult to observe, and a description of all the various specific clinical manifestations would be superfluous. Lameness is always a symptom which might be associated with joint disease. Swelling about the joint is another cardinal symptom, although swellings in this region may occur without joint involvement. Close inspection and manual manipulation will usually disclose such differences. Abnormal appendicular alignment, that is, abnormal flexion, extension, adduction or abduction of the limb or parts of the limb, are suggestive signs of articular ailment. When articulations of the vertebral column are involved, the pigs tend to support themselves so as to immobilize the joints affected and also reduce pressure effects. This they do by arching the back and loins and lowering the sacrum, by allowing the column to sag, so-to-speak, or to bend to one side or the other. It is, of course, almost impossible to determine by physical examination the specific vertebral articulations that are affected.

The treatment of arthritis in swine is more easily described than accomplished. However, effective treatment can be performed in some cases while in others the results bring no satisfaction. There is no biological reason why some cases of arthritis, especially the serous type and selected cases of the suppurative and exudative types, cannot be treated in accordance with accepted surgical procedures. The breeding and economic value of the animal will usually have to determine whether such treatment should be undertaken. In herds where a number of cases of arthritis existed at one time, attempts have been made to control or alleviate the condition by specific and nonspecific biological therapy. In general, these have not produced the results desired. More study should be given to this phase of the problem. The greatest assistance that can be rendered toward the control of some of these cases rests in the matter of prevenion. It is advisable to insist upon clean and sanitary swine husbandry practices. This will tend

to reduce infectious causes. Especially is this true when the disease has occurred as an enzootic. The application of tincture of iodine or some other suitable antiseptic to the navel will do much to prevent infection via this route. There is some evidence to indicate articular infections sometime occur *in utero*. Just how much of a factor this really is, no one knows. However, it is always good practice not to use sows for breeding purposes that show uterine disease.

Non-inflammatory Diseases of Joints

One of the more common arthropathies of a non-inflammatory nature is the articular change occurring as a result of mineral deficiencies. Some rather striking abnormalities involving the articular cartilages in particular have been observed in swine supplied with rations low in calcium. The cartilages were wrinkled and folded, and ofttimes erosive-like changes were observed. Animals, in which joint changes occur to such an extent, are very lame and evince great pain when attempting to move. In less severe cases the joint cartilages may be thin and purplish-blue in color, but the underlying osseous tissues are comparatively soft. Thick, fibrous periarticular changes are not uncommon in cases showing symptoms of articular distress resulting from mineral deficiencies. Arthropathies resulting from these causes usually occur in more than one joint, and the joints of the limbs are most often involved.

The treatment of conditions of this kind, excepting those with marked articular changes, is relatively simple and highly satisfactory. The essential point is that the diet must be fortified with bone-building elements since the joint manifestations are secondary to changes occurring in the bones. Calcium is the principal mineral element most likely to be deficient, and this can be supplied by including bonemeal as a part of the ration. By using a high quality steamed bonemeal at the rate of from 3% to 4% of the ration, sufficient mineral elements will be provided. The addition of vitamin D will augment the utilization of these elements and effect a recovery in much shorter time.

Other joint diseases that might well be included in the category of noninflammatory arthropathies are those due to prenatal influences (congenital anomalies, congenital dislocations, congenital contracture of ligaments); traumatic injuries of various kinds; spastic paralytic contractures of muscles; flaccid paralytic dislocations; and joint diseases resulting from tumors. Conditions of this kind are relatively rare but occasionally are encountered by the veterinary practitioner and the veterinary inspector at stockyards and packing plants.

Left: Rachitis (Calcium deficiency) in a yearling boar, showing the general attitude. Walking was difficult because of the painful joints which caused him to stand on his toes, and interfered with his use for breeding.

Porcine Brucellosis

By F. M. HAYES,
University of California,
Davis, California

Introduction

Porcine brucellosis is a specific infection of hogs caused by the porcine variety of *Brucella abortus*. The disease in hogs should be recognized as separate from Bang's disease in cattle, and should be given the same study and economic significance, although the aggregate losses probably do not at this time approach those caused by Brucella infection in cattle. Also, from the standpoint of transmission to and virulence in human beings the porcine disease is of equal if not more importance. It is essential that practitioners of veterinary medicine should be as well informed on all of its characteristics as on those of other infectious diseases of animals that are transmissible to man and that at the same time occasion serious losses to the livestock industry.

History

The first definite information that swine in the United States may be attacked by a member of the Brucella group with resultant abortion as the outstanding symptom, was first given in the Report of Chief of Bureau of Animal Industry, June 30, 1914. A Brucella type of organism had been isolated from an aborted fetus in 1913 by Dr. Jacob Traum while he was working in the pathological division of the Bureau of Animal Industry, United States Department of Agriculture. With the methods available at that time, Traum's organism could not be distinguished from *Br. abortus* from cattle. Previous to this time reports had been made of abortions among sows, but no organism related to the Brucella group had been identified as the cause. Later—in 1916—Good and Smith of the Kentucky Agricultural Experiment Station proved the infectious nature of the abortus type of organism which they obtained from the afterbirth and fetal tissues from a swine herd in which abortions were occurring. In the same year the disease was noted in Missouri, and Connoway, Durant, and Neumann found that aborting sows reacted to serological tests with the same antigens used for the diagnosis of Bang's disease in cattle.

From 1918 to 1922 inclusive great interest was stimulated in the study of the causes for abortions in sows, which had reached in this period, alarming proportions. During this time, and since, numerous investigators have confirmed the results of the above mentioned research workers, added much to our knowledge of porcine abortion, including methods of typing the varieties of *Brucella*, and definitely established swine brucellosis as a specific infectious disease.

Epizootology

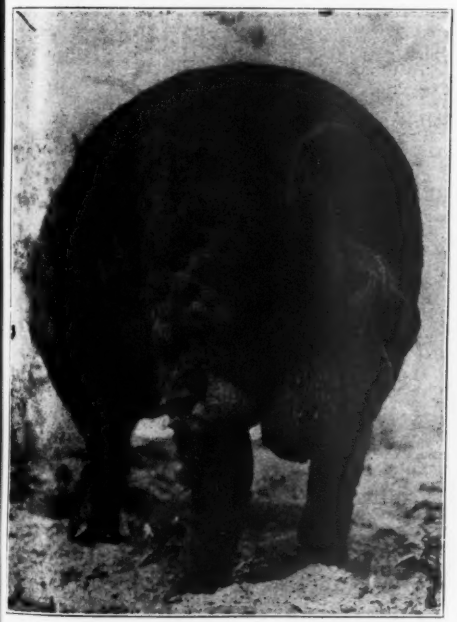
The history of this disease in hogs is showing the usual characteristics of a spreading infectious disease, in that there have been periodic extensive outbreaks that reached a peak and subsided, only to flare up again in the same herds or sections of the country, each time with a wider distribution evident. Some have called swine Brucellosis a self-limiting disease. All infectious diseases are limited by the proportion of susceptible individuals, and rises and falls in epidemics are dependent largely upon the number of susceptible and immune individuals in the population. These factors and the short normal life of the hog are responsible for the slow spread of the disease and the intervals between epizootics. But all signs indicate a gradual and insidious spread throughout the herds of this country, and unless more attention is given to the problem, the time will come when the economic significance of porcine Brucellosis will be proportioned to that of Bang's disease in cattle.

There are no satisfactory figures to indicate the amount of Brucella infection in hogs, but from the data which have been published, and from our own observations in California, certainly more than 5% of the swine herds are affected. This figure approximates the estimated amount of tuberculosis in cattle that existed when the

great need for some plan of control was recognized and the accredited herd and area plans were instituted.

Symptoms and Pathology

The clinical signs of Brucella infection of hogs unfortunately furnish no index to the amount of infection which may exist in a given herd. Many infected herds and infected individuals show no apparent physical disturbance. The truth of this statement is apparent when Brucella infection in man, cattle, and other animals is also considered. This characteristic seems to be common to most Brucella infections. Differences in virulence, size of doses, and susceptibility, all contribute to the variable clinical signs. However, it is well known that herd infection causes constant difficulties of numerous types which in the end render the infected herd less productive than the herd, free from infection. Often the clinical symptoms are spectacular and the losses serious. Of course, the most apparent symptom is that of premature birth of the entire litter, usually occurring somewhere between six and twelve weeks after conception, or the presence of one or more dead fetuses in an otherwise normal litter. This is the symptom which generally causes the hog owner to engage the services of the veterinarian. Other and more insidious symptoms are overlooked or laid



Multiple Subcutaneous Abscesses in a Duroc Boar

Fig. 1. Orchitic testicle in purebred Poland. Agglutination titer at this time, 1:25,600.

to other causes. Sterility is frequent, following abortions, and occurs even in gilts. Orchitis is very common in breeding boars. In addition to these usual and more outstanding symptoms, chronic and periodic attacks of lameness, due to bursitis and arthritis, have been reported. Deaths are not common, but a few cases have been reported in which the evidence seemed to point clearly to *Brucella suis* as the specific cause. It is undoubtedly true that Brucella infection may initiate complications and thus be the indirect cause of some mortality.

Notwithstanding the frequent lack of pathological changes on autopsy of infected hogs, *Brucella suis* can and does occasionally cause extensive lesions. Some infected hogs show subcutaneaus and internal abscesses. Caseous nodules have been observed in the liver, spleen, and kidney and necrotic types of lesions in the vertebrae. Creech has recently reported an abscess at the base of the brain, between the hemispheres, in a sow which yielded *Brucella*

suis on culture. Serious metritis in sows, following abortion, does not seem to be so common as in cows affected with Bang's disease, but there is frequently a purulent catarrhal exudate from the uterus after abortions. This has also been observed in unbred gilts. Axel Thomsen of Copenhagen, in his excellent monograph on Brucella infection in swine, reports that about 47% of the uteri from the infected sows that he studied, shows a "miliary brucellosis," as he designated it, which was characterized by the presence of nodules in the endometrium, of approximately the size of hemp seed, which contained Brucella organisms. Miliary foci have been described in the ovary, together with cystic enlargement of the follicles, from which the Brucella could be isolated. The testicles or orchitic boars undergo caseation necrosis.

Transmission

There is no evidence to indicate that there is any great danger of the transmission of Bang's disease from cattle to hogs, but on the other hand, there is unmistakable evidence that *Brucella suis* can establish itself in the body of the bovine and even cause an abortion. Most of the latter results have been brought about by artificial experimental infection. Practically all of the experiments carried out to test the intertransmissibility between swine and cattle under pen or corral conditions, even under the closest contact, have shown no signs of transmission of *Brucella abortus* to hogs and only an occasional development of agglutinins in the blood of cows, presumably from the porcine strain. However, *Brucella suis* has been isolated from milk from the bovine udder by several investigators. Considering the recognized virulence of the porcine organism for man, the latter findings strongly suggest that dairy cattle, whether free from Bang's disease or not, should be denied intimate contact with hogs.

Not all of the methods by which *Brucella suis* may be spread from one hog to another have been established. It is known by direct experiment that invasion of the organism, with agglutinin response, may take place through the conjunctiva, skin and mouth. These probably constitute the usual methods of natural infection. The discharge of the organism from the body of the infected animal is known to occur in the lochia following abortions (but apparently not so frequently as in the case of cattle) in the lochia from infected sows farrowing normally, in the urine and in the semen of boars.

Studies on the tissues of infected hogs indicate that *Brucella suis* is widely distributed within the body, whereas it is generally thought that *Brucella abortus* in cattle is limited to restricted areas. Except for the genital tract of aborters, the most frequent location of the organism is in the submaxillary and superficial lymph nodes. The bronchial and gastro-hepatic lymph nodes also, frequently contain the germ. Practically all of the glands are found to harbor the infective agent in an animal that is recently infected or that carries a blood titer of over 1:200. No difficulty is experienced in obtaining positive cultures from an orchitic testicle or from the seminal vesicles of infected boars. Considering this wide distribution of the organism in the body, it is surprising that there are not more clinical signs of illness.

Diagnosis

The diagnosis of Brucella infection in swine can be made readily by the agglutination test as generally carried out and interpreted in testing cattle blood. The agglutination test is as satisfactory and trustworthy when used on hog blood as on cattle blood. Perhaps a higher percentage of infected swine, than of infected cattle, react in the low dilutions, and the suspected group is comparatively greater.

The agglutinins develop promptly after exposure, but with the majority of infected swine there is a decided tendency for the titer to drop within a few months to a year. However, many retain a titer of from 1:200 to 1:500 for two or three years or more. Swine seldom continue, for long, to give positive reactions in dilutions above 1:500. Complement-fixation tests are unnecessary, although this test is highly satisfactory. Allergic skin tests have not proved dependable in our experience.

Several different types of 'abortins', intradermally applied, have been experimentally used by the writer and the conclusion was reached that they have no practical value in diagnosis. Unless correlated with serologic and opsono-cytophagic tests it is impossible to distinguish between active infection and immunity, and such a procedure would not be practical for routine diagnosis.

Fig. 2. Method of restraint and approximate location of superficial veins on the ear.

Fig. 3. Collecting the blood sample from the ear of the sow shown in Fig. 2.

Following the administration of an infective dose of *Brucella suis* by mouth there is a marked rise in the phagocytic index. Our own experiments with the opsono-cytophagic tests on six sows every two weeks for over a year have shown that the index for the normal non-infected sow of breeding age is near 10.0 and that it rises quickly after invasion of the organisms given by mouth, to as high as 50.0 with an average of 35.0 maintained during a period of four to six months. After a year the index dropped to nearly that before infection. Agglutinins made a corresponding decline.

The collection of the blood sample from the hog is a simple procedure when taken from the ear veins or from the tail. The inexperienced may have some difficulty until the technique has been practiced a few times. The puncture of an ear vein is the preferred method. Other superficial veins cannot be used readily in the hog, and it takes longer and in many cases is undesirable to cut off a piece of the tail. The ears need to be dry and clean, but not disinfected. One of several of the veins on the dorsal surface of the ear is incised with a sharp-pointed scalpel, such as the Bard-Parker blade No. 11. Blood usually drops freely off the margin of the ear and can be collected in an appropriate-sized bottle. If the ears are cold, friction by rubbing with the hand or the handle of the knife may distend the veins. Clamps and artificial heat are not required. It is impractical and unnecessary to attempt to collect the blood by hypodermic needle except for special bacteriological tests.

Control

A positive diagnosis of Brucella infection is made if the blood serum completely agglutinates an antigen concentrated to a Gates 4.0 or McFarland 2.5, in a dilution above 1:50. Complete agglutination in 1:50 is considered as highly suspected, and in badly infected herds as positive, if the reactors are to be removed from the herd. A significant percentage of hogs showing the latter reaction have been shown to carry Brucella in their tissues, though they may not be spreaders.

The control and eradication of Brucellosis in swine is dependent on identifying

the reactors to the agglutination test, on eliminating them from the herd, or segregating them to other quarters, and on raising the offspring in an uncontaminated environment. Vaccination has not yet been tried on a scale large enough to recommend its use. The following outline of practical procedure is suggested to practitioners who wish to assist their clients in developing a clean herd. The plan naturally applies more particularly to pure-bred, breeding herds and to small herds than it does to large grade herds which are in the business to produce market hogs on a large scale.

1. Make agglutination tests at least once a month as long as reactors are found, or even as often as every two weeks if the number of reactors has not materially decreased after two monthly tests.

2. Consider all swine of breeding age as suspects if their blood shows complete agglutination in 1:50 dilutions with an antigen of a Gates 4.0 concentration.

3. If the plan of raising the offspring of infected sows is adopted, the pigs should be segregated at weaning time or shortly thereafter. Experience has shown that no elaborate facilities and no great distance from the infected herd are necessary.

4. When the segregated pigs have reached breeding age, they should be tested and the negatives retained.

Under this general plan, several groups of weanling pigs have been raised to maturity without infection, from our own herd of positive experimental sows. The results have been accomplished with very unfavorable physical equipment which was in no way better than that found on the average farm. Under the plan of removing all reactors from the breeding herd at the University of California, the herd has been maintained free of reactors for the past five years. In 1929, there were 42% positive and 6% suspected individuals in this herd. Many private herds in the state are following this procedure with success.

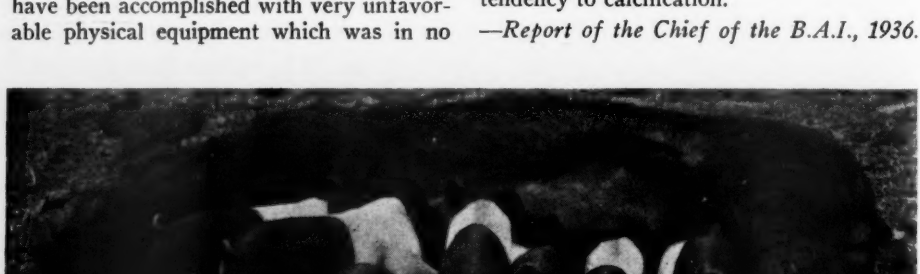
It is believed that methods for the control of Brucella infection in swine have now been developed and successfully demonstrated to a point where swine as well as cattle can and should be included in plans for official recognition of disease-free herds.

* * * *

Brucella Suis Infection

An unusual case of *Br. suis* infection was diagnosed during the fiscal year 1935-36 by the Pathological Division of the B.A.I. The gross lesion consisted of a large encapsulated abscess, or grayish necrotic mass, approximately 3½ inches in diameter, situated between the hemispheres at the base of the brain. Pure cultures of *Br. suis* were obtained directly from the necrotic lesions. Histologically, the heavily encapsulated lesions consisted of both large and small necrotic centers surrounded by wide vascular zones of cellular infiltration, consisting of fibroblasts, lymphoid and mononuclear cells, epitheloid cells, and large numbers of eosinophile cells. In some of the larger necrotic areas there was some tendency to calcification.

—*Report of the Chief of the B.A.I., 1936.*



Major Acute Infections In Swine

By FRANK BREED,
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The Author

HOG cholera stands out today as the most prevalent acute infectious disease of swine. This disease has ranked first in prevalence and mortality for time out of memory in the swine industry in the United States. However, other acute infectious diseases also cause heavy losses. Among these are infectious enteritis and swine erysipelas.

Hog Cholera

Cause.—Hog cholera, an acute, febrile, highly infectious disease, is caused by a filterable virus.

Symptoms.—In the usual outbreak, the first noticeable symptoms are that one or two pigs fail to eat and that they segregate themselves from the herd. After a few days (four to seven), other animals stop eating and withdraw from the herd, with a tendency to stay in the nest. Observation of the herd at this time will show that still others are "going slow." In other words, their appetites diminish and finally cease altogether; thirst increases; activity slows up, and temperatures in these slow animals range from 104° to 105° F. The animals remaining in the nest show reluctance to move out. When they are driven up, they walk only a few steps at a time. The gait is unsteady and staggering, and the heads are lowered. Quite a characteristic attitude assumed by these animals is that of a depression of the central nervous system. They stand with heads lowered, eyes fixed, (if not glued shut with exudate) as though they were in deep thought. If handled, they offer no resistance. There is a lack of squealing.

Factors Required for Field Diagnosis.—(1) History of the outbreak; (2) behavior of the animals—complete physical depression; (3) appetite—greatly impaired or completely lost; (4) temperature—varying between 104° and 106° F.; and (5) duration of the disease—four to seven days, occasionally 14 days, until fatal termination.

Pathological Changes.—The eyes may show a slight clouding of the cornea together with a sticky mucoid exudate, causing the eyelids to be glued shut.

The lymph glands, especially those adjacent to the digestive tract, are slightly swollen and show hemorrhages involving the entire gland. In certain outbreaks, the diffuse hemorrhage may be lacking; instead, a marble appearance of the gland may be observed. Petechiae are present on the surface of the kidneys, but should be few in number, unless secondary bacterial invaders are present. Small hemorrhages are also present in the cut surface of the cortex, but not in the medulla.

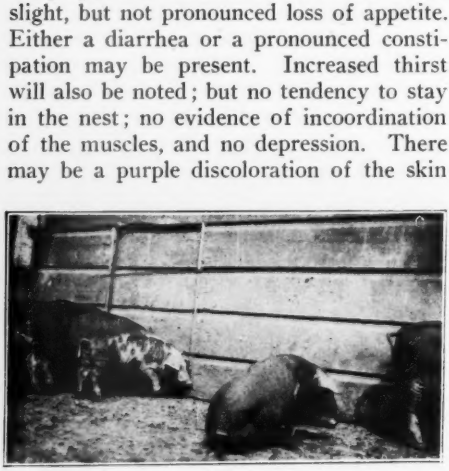
A distinct petechiation, without other pathological changes, is present on the bladder. The stomach is usually completely empty or contains a very small amount of ingesta. The mucosa is swollen and in many instances shows a diffuse hemorrhage. Ulceration of the mucosa may be present in certain outbreaks, but it is questionable if the pure virus is the direct cause.

Infectious Enteritis (Pig Typhus)

Contrasted with this picture is that of acute infectious enteritis, which occurs more frequently in rapidly growing herds, and in this type of herd, following simultaneous vaccination.

Cause.—Infectious enteritis is due to one or more members of the paratyphoid-enteritis group. The two most frequent offenders are *Salmonella suipestifer* and *Salmonella schottmueller* (*B. paratyphosus B.*). Probably the most universal is the *S. suipestifer*. When infection by these germs appears, it usually affects a large percentage of the herd; at least, it seems that way to the owner. The first cases are not so outstanding and noticeable to the farmer as are cases of cholera.

Symptoms.—The herd as a whole shows slight, but not pronounced loss of appetite. Either a diarrhea or a pronounced constipation may be present. Increased thirst will also be noted; but no tendency to stay in the nest; no evidence of incoordination of the muscles, and no depression. There may be a purple discoloration of the skin



of the abdomen, which persists in spite of pressure, prior to death. This may be accompanied by sudden deaths, and, after the first week of the malady, evidences of chronicity may appear. It will be noted that there is no complete cessation of eating as in cholera. The eyes are injected, but otherwise there is no impairment. The temperature may range from subnormal to 107° or 108° F.

Factors Required for Field Diagnosis.—(1) History of the outbreak; (2) behavior—the herd, as a whole, does not appear to be greatly stricken, some individuals may show slowness, but there is a lack of the pronounced physical depression seen in cholera; (3) appetite—all come out to eat with more or less eagerness, none stay in the nest; (4) temperatures will range from subnormal to 108° F.—it will be noted that many animals are still active and enjoy comparatively good appetites, in spite of these temperatures; and (5) duration of the disease—dead individuals may be found at the outbreak of the infection, but the bulk of the mortality is usually within the first 7 hours—those animals that do not die become chronic sufferers and carriers of the infection.

Pathological Changes.—The stomach is usually filled. The contents are sour and offensive. The mucosa is swollen and the greater portion is covered with a deep, beef-steak-red hemorrhage. Ulcers are usually present in the various stages of formation.

The colon and cecum exhibit inflammatory changes at the ileo-cecal valve, consisting of caseation or typical ulcer formation. The mucosa is swollen and edematous, presenting individual circumscribed ulcer formation or a diffuse diphtheritic deposit.

The lymph glands, that is the superficial inguinal, mesenteric and portal glands seem to show the most constant changes. They are greatly swollen and edematous. A clear, or straw-colored lymph will drain from the gland when incised. The lobules seem to stand out plainly, but there appears to be a lack of hemorrhage and hyperemia.

The kidneys remain about normal in size, color and consistency. There may be a slight congestion, giving a deep mahogany color. Rarely are there hemorrhages on the surface. Occasionally, large, irregular hemorrhages, dark in color, may be present. On cut surfaces there appear no hemorrhages in the cortex, but in the papilla, large, dark hemorrhages are manifest.

The spleen presents pronounced enlargement and congestion. The capsule ruptures easily, and the spleen pulp is very soft. The color is usually changed to a dark purple, or almost a blue black.

Swine Erysipelas

Another acute, infectious disease, which may be confused with the clinical picture of hog cholera, is swine erysipelas. Of this group of acute infectious diseases, erysipelas is the most recently recognized and must be given careful consideration. Its importance is very much on the increase, due to the comparatively high mortality which, at times, accompanies it. Other serious factors are the economic losses from the chronic type of the disease, usually an aftermath of an acute outbreak. The transmission of the infection to man has been recorded a number of times and should be looked upon with a great deal of respect.

Cause.—Swine erysipelas is an infectious disease caused by *Erysipelothrix rhusio-*

pathiae. This infection may manifest itself in four forms: (1) as an acute septicemia; (2) as a benign urticaria (diamond skin disease); (3) as a chronic valvular endocarditis and arthritis, and (4) as a necrotic dermatitis.

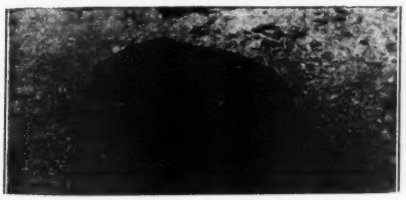
Symptoms. — Erysipelas may appear in the herd in a more or less light and transient form. Owners have stated that "the herd had a slight attack of flu, which affected almost the entire herd." This statement, particularly during the warm months of the year, should lead one to be suspicious. After this first attack, there may be be another in about 10 to 21 days, exhibiting a very acute form and resulting in comparatively high mortality in the first three or four days. Subsequent to this period, the mortality lessens and those still ailing will begin to show some chronic disturbances, swelling of the joints, drying of tails or ears, drying of the skin over the shoulder and back, etc.

The temperatures in the diseased animals may reach 107° to 109° F. The appetites are somewhat impaired, but the animals continue to eat a little. Thirst increases. There may be a tendency to withdraw from the herd and to remain in the nest, but when individuals are aroused they seem to have an excessive amount of vitality and are difficult to catch. There is evidence of soreness in either the feet or joints and a tendency to stand on the toes of the front and hind feet alike. The back is exceedingly arched with a drawn, or tucked up, attitude of the abdomen. The head is lowered to conform in line with the arching back. There is no depressed appearance of the eyes.

There may be a discoloration of the skin of the back, but more frequently of the abdomen, arms and thighs. The color is a brilliant red or scarlet and is due to a congestion of the skin capillaries; for, the skin blanches completely when pressed between thumb and fingers.

The chronic form may follow the acute attack, resulting in swollen joints, formation of large, dark, thick scabs over the shoulders and extending backward, loss of tails, ears and, occasionally, the claws.

Factors Required for Field Diagnosis.— (1) History of the outbreak; (2) behavior —early in the disease there is a slight physical depression, the animals stand with all four feet close together, producing an excessive arching of the back and a tucked up appearance of the abdomen. When the animals are disturbed, they show an excessive amount of vigor, being difficult to catch; (3) appetite—animals continue to eat, but the appetite is impaired; (4) temperature—early in the outbreak the fever



ranges from 106° to 108° F.; and (5) duration—some animals die within 24 hours, while others last for 96 hours, the greatest mortality in the acute disease occurring within the first 96 hours.

Pathological Changes.—Many of the affected animals show a pronounced scarlet discoloration of the skin along the belly, on the thighs and axilla. The discoloration may extend to the throat region. It may occur in definite circumscribed areas, varying greatly in size, or it may occur as one diffuse area, involving the entire abdomen. This discoloration of the skin is not a hemorrhage, but a congestion and blanches on pressure.

The extremities may be hot, swollen and tender to the touch. The claws show congestion and the pads of the feet are hot and swollen. The joints may be enlarged; in chronic cases, a sloughing of the ears, tails, and, in some instances, of the feet, is observed.

In the acute form of erysipelas there is little, if any, change in the heart which can be detected on gross examination. In the chronic form, the heart is enlarged, flabby, pale and may show a cauliflower-like growth on the valves of the left heart.

The lymph glands, that is, those adjacent

to the digestive tract, usually show the greatest change. They are highly swollen, edematous and contain a blood-tinged lymph, which drains from the organ on incision. There may be a marble appearance to the cut surface of the gland.

The spleen is either normal in size or moderately swollen. The color may be a bright scarlet or an exceedingly deep red. It is due to congestion, no hemorrhage being involved. The stomach may be completely or only partly filled. The ingesta are not manifestly in a state of fermentation. The mucosa is scarlet in color. This discoloration may occur in circumscribed areas or it may cover diffusely nearly the entire lining. A lack of ulcer formation is noticeable.

The appearance of the kidneys is of significance in the acute swine erysipelas. The size is normal, but there is a diffuse nephritis with hemorrhage formation on the surface. There may be a spattering of the surface with hemorrhages, which vary greatly in size and shape. The hemorrhages may be either irregular in outline, or lenticular, or perfectly round. They are usually of a bright red color. In the chronic form of erysipelas, the kidney is pale, firm and will show an interstitial nephrosis.

The problem of differential diagnosis not infrequently confronts the practicing veterinarian, from the point of view of the pathological lesions found. These diseases, which are the most important infectious diseases of swine in this country, are exceedingly difficult to attribute to their individual and specific etiological agents.

Instances occur where two of the maladies affect the herd at the same time, and in fact it is not unusual to have two of the infecting agents present in the same animal. The lesions, produced in general by all these individual agents, denote primarily a septicemia. Therefore, it is most difficult to select certain pathological changes and feel assured that a certain etiological agent is the true and uncomplicated cause. Those who are trained in pathology, and who have spent years studying the diseases of swine, hesitate to make positive statements relative to pathological lesions found on necropsy. Granting that the foregoing statements are true, how are we to make at least a tentative diagnosis of these three diseases with some degree of accuracy.

Earlier in the presentation of this subject, under the subtitle "Factors required for field diagnosis," are offered certain facts which are of diagnostic value in each specific disease. The pathological changes enumerated in the organs chosen are quite constant for that particular etiological agent. The changes cited are not the only ones for there are changes in certain organs, denoting a septicemia only, which seem to be present for all three diseases.

For confirmation and checking purposes, specimens consisting of blood and other diseased organs should be collected as asepticly as possible, properly preserved and forwarded to a diagnostic laboratory for further examination. These can be checked bacteriologically either for *Erysipelothix rhusiopathiae,* or for *S. suipestifer,* or for both. To determine the presence of the virus of hog cholera, the filtration of the blood and of extracts of the organs has to be carried out as a preliminary step to the inoculation of susceptible swine.

The Problem of Disease Control

The accompanying chart is for reference only and is not intended for differential diagnosis. It contains the lesions usually found in these diseases in any organ of the animal's body in which there is a change, regardless of its importance in diagnosis.

The primary object in presenting these three infectious diseases is not that of laying down hard and fast rules for differential diagnosis; but to place in the hands of those vitally interested in swine diseases —particularly the practicing veterinarian— the outstanding and salient symptoms and pathological changes which *usually* accompany these different diseases.

It must be borne in mind that the diagnosis of swine diseases seems to become more difficult from year to year. The veterinary profession, and particularly those in practice, must give more careful consideration to the diagnosis and prevention of these

diseases by sanitary and biologic control.

At all times, when dealing with a sick herd of swine, the practitioner should keep uppermost in mind that hog cholera is still the classical and most prevalent acute infectious disease of swine in the U. S.

Summary of Usual Lesions Found in these Diseases

Organ Affected	ERYSIPELAS	INFECTIOUS GASTRO-ENTERITIS (SUIPESTIFER)	HOG CHOLERA
Skin	Scarlet, congested, circumscribed areas or diffuse. Blanches on pressure.	Normal or may show purple hemorrhage before death.	Hemorrhage, circumscribed or diffuse. Does not blanch on pressure. Turning dark before death.
Eyes	Watery discharge, injected conjunctiva. Lids not glued.	No apparent change.	Slight clouding of cornea, sticky mucoid discharge, glueing of lids.
Extremities	May show swelling, hot and tender. Joints enlarged, feet injected and tender, claws congested, pads swollen, sloughing tail and ears.	No apparent change.	Knuckling of pastern joint.
Heart	Acute: Not much change. Chronic: Enlarged, flabby pale and possibly cauliflower growth on valves in left heart.	In septicemic form may show hemorrhages, otherwise normal in appearance.	Normal except in certain outbreaks. Petchial or diffuse hemorrhages on auricles especially right auricle. Hyperemia of ventricle.
Lungs	Acute: Normal to congested. Chronic: Edema in cases with valvular lesions.	Acute: No apparent pathological change. Chronic: May show pneumonia of suipestifer origin.	Apparently normal with many bright red hemorrhages on surface. In certain outbreaks pneumonia is quite constant.
Lymph Glands	Adjacent to digestive tract-swollen, edematous with blood tinged lymph. Marble appearance of gland tissue in many outbreaks.	Adjacent to digestive tract. Swollen and engorged with straw colored or clear lymph. May show congestion.	Slightly swollen. Hemorrhages involving entire glands. Marble appearance of gland tissue in many outbreaks.
Stomach	Completely or partly filled. Mucosa, scarlet red, circumscribed areas or diffuse discoloration, covered with thick sticky mucoid exudate. Lack of ulcer formation, ingesta fermented.	Usually filled. Contents sour and offensive. Mucosa swollen beefsteak red. Usually ulcers in various stages of formation.	Empty or few ingesta. Mucosa swollen and may show diffuse hemorrhage. Ulceration may be present.
Intestines	Usually not much change. May have mucosa swollen and injected in duodenum.	Mucosa swollen. Contents bile stained exudate.	Severe enteritis involving mucosa and submucous tissue. May be accompanied by hemorrhages in mucosa.
Colon and Cecum	May show mucosa edematous and studded with small hemorrhages, but no ulcer or diphtheritic exudate formation.	Ileo-cecal valve inflamed with ulcers. Mucosa edematous, swollen, necrosis and ulcer formation.	Severe enteritis involving mucosa and submucous tissue. May be accompanied by hemorrhages in the mucosa.
Kidney	Size normal. Acute: Diffuse nephritis. May have hemorrhages on surface, varying in size and shape, but bright red. Chronic: Usually pale, firm, showing interstitial nephrosis.	About normal in color or congested, usually no hemorrhages on surface, but large irregular hemorrhage in papilla.	Petechia on surface, few in number. Also present in cortex on cut surface. Hemorrhages lacking in medulla.
Spleen	Normal in size or moderately swollen. Bright red or deep red discoloration. No hemorrhages but congested.	Swollen, congested, soft in consistency. Dark purple or almost blue black in color.	No change in size. May show hemorrhages on border. Dark in color.
Bladder	Mucosa thickened and congested. May show hemorrhages irregular in size and outline.	May show some congestion. In certain outbreaks, entire mucosa involved with extensive hemorrhage formation.	Distinct petechiation of mucosa.

Swine Erysipelas

By T. W. MUNCE,
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The acute forms of swine erysipelas are septicemic in nature, while its more chronic forms are frequently characterized by arthritis, pathological processes of the skin, and a variety of secondary complications.

In the United States, the causative organism was first isolated from swine by Theobald Smith in 1886. Diamond skin disease was recognized for many years before it was identified as a mild or chronic form of swine erysipelas. Herd histories indicate that the highly serous, septicemic forms of the disease have existed in some sections of the United States since 1925 or longer.

Geographic Distribution.—In the Western hemisphere, the existence of swine erysipelas has been confirmed at such widely separated points as New York, Texas, Saskatchewan and Brazil. In the United States, a survey in 1933 revealed its recognition in 17 states. It is most frequently encountered in the middle western states, or in sections where the swine population is dense. However, our modern facilities for transporting swine great distances may, at any time, result in the exposure of swine in practically any section of the country.

Cause.—Swine erysipelas is caused by *E. rhusiopathic,* a slender, gram-positive, nonsporulating, rather highly resistant, rod-like or thread-like organism, which is infectious for swine, sheep, rabbits, white mice, gray mice and pigeons. It has been isolated from cattle, chickens, turkeys and ducks by European workers. In America it has caused at least one outbreak of a fatal malady in turkeys. It is also infectious for man, causing "Erysipeloid," a rather serious disease of the skin. To date a number of veterinarians have been infected.

Seasonal Prevalence.—The disease may occur during any season of the year, however, it has been encountered most frequently during the spring, late summer and fall months. Apparently there may be a marked fluctuation in its prevalence from year to year.

Duration of Infection on Premises.—Periodic outbreaks on some farms appear to indicate that the infection may be carried over from year to year in the bodies of swine, or by other means, for a period as long as ten years. On other premises only one outbreak has occurred, in spite of the fact that the premises have been used continuously for raising swine.

Age of Swine Affected.—A majority of the cases have been observed in animals weighing from 60 to 160 pounds, however, swine of all ages have been affected. Contrary to the opinion of some writers, it can cause serious losses in suckling pigs and in adult animals.

Morbidity and Mortality.—In some untreated herds, practically all of the animals have died; in others the disease has ceased spreading, and practically all of the infected animals have recovered. The reports of competent observers in different parts of the United States indicate that an average death loss of 10% to 30% of the animals in untreated herds has been observed. These observers also report that an additional 10% to 20% of the animals in such herds have developed chronic forms of the disease which have practically destroyed their value.

Transmission.—The factors involved in the actual transmission of swine erysipelas from animal to animal are not well understood. Until definite information is available on this point, prudence demands that the disease be regarded and handled as both contagious and infectious.

Manner of Spreading Through Herd.—The manner or extent of spread in an untreated herd cannot be predicted. In some herds a small, or large, group of animals have sickened almost simultaneously, and no additional cases have developed. In other herds, additional groups have sickened after an interval of several days or weeks. In other instances, one or more

cases have developed daily until the disease ran its course.

Course.—The course of swine erysipelas varies greatly in different animals and in different herds, depending chiefly upon the form of the disease under observation. When the complete course of a severe, septicemic attack is observed, it may be divided into three periods or stages:

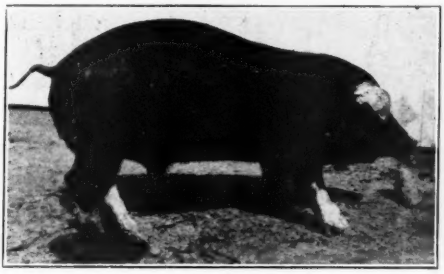
1. The acute stage, (first three or four days of illness).
2. The intermediate stage, (from fourth to tenth day of illness).
3. The chronic stage, (following tenth day of illness).

Some animals apparently experience only the acute stage of an attack; some show symptoms of only the acute and intermediate stages, while others develop the chronic form of the disease without showing observable symptoms of the earlier stages.

Symptoms

Acute Stage.—The history frequently reveals one or more sudden deaths. The sick animals withdraw from the herd and lie in their beds. When aroused, they show a surprising degree of animation, which is in contrast to the marked degree of mental depression usually observed in cholera affected animals. The appetite may be diminished, but it is rarely entirely inhibited. The temperature is elevated and usually ranges from 104° to 106° F. Respiration may be increased. Constipation is usually noted. Rather characteristic early symptoms are an arching of the back, a stiff gait and evidence of pain when handled. In uncomplicated cases, coughing, diarrhea and vomiting are seldom observed in this stage. The majority of deaths occur about the fourth day, after which the balance of the affected animals recover or progress to the intermediate stage of attack.

Intermediate Stage.—This stage has not been reported in all sections, but when it occurs, it is characterized by extreme weakness and prostration. The afflicted animals may be found lying helpless on their sides. If they can walk, the gait is stiff, staggering and stilted. The temperature may reach or exceed 108° F. Inappetance is complete. There is no diarrhea in uncomplicated cases, but the feces may be soft and brown or greenish in color. Other symptoms include stocking or swelling of the legs; swelling of the skin of the eyelids, snout



and ears; a red or purplish-red color of the skin of the abdomen, axilla and other thinly covered parts. The skin of the shoulders, sides or back may present thickened or infiltrated areas varying in size from some areas resembling insect bites to others which may involve the entire back. Some swelling of joints of the legs and other early indications of approaching arthritis may be noted in at least some of the animals. The surviving animals either recover or turn to the chronic stage of the attack.

Chronic Stage.—The temperature usually returns to approximately normal. The animals regain some strength, but they are usually weak and easily exhausted. They may spend much of their time lying on the

Swine Erysipelas

sternum or sitting upright to facilitate respiration. Labored breathing and chronic cough are frequently observed. The appetite is capricious. Arthritis involving the joints of the legs is frequently a prominent

development. Gangrenous processes involving the skin of the ears, snout, back, sides or tail may develop. A great number of secondary complications may occur during the chronic stage, such as pneumonia, carditis, enteritis, hepatitis, etc., therefore a great variety of symptoms may be noted.

Lesions

Acute and Intermediate Stages.—The lesions vary with the severity of the attack and the extent to which the disease has progressed in its course; early in an attack they may be so slight as to escape detection. External examination of the carcass may reveal some of the skin changes or joint conditions described under symptoms. The subcutaneous fat may be dark or yellow. The abdominal cavity may contain an excessive amount of straw-colored fluid; this fluid may or may not exhibit shreds of fibrin. The liver is usually enlarged, firm, brittle and engorged with blood or bile. In some cases the spleen appears normal; in others it is swollen throughout, or in part; the parenchyma of the swollen portion is dark and soft, but rarely fluid; frequently the only lesions are a few raised, dark areas on the capsule. The kidneys usually are light in color, friable and may show petechiae. The lining of the bladder may show passive congestion and hemorrhagic areas. Frequently some of the lymph glands are enlarged and succulent due to the presence of an amber colored fluid; later in the attack some glands may be congested with blood. Petechiae may be observed in one or more glands. The stomach quite regularly reveals some degree of gastritis and on its serous coat may show, in some cases, a striped hemorrhagic lesion known as a "paint brush" hemorrhage. The pericardial sac may contain an abnormal quantity of straw-colored fluid. Irregular hemorrhagic areas may be observed under the epicardium over the auricles. In uncomplicated cases the lungs seldom reveal gross lesions, although in some instances pin-head to pea-sized hemorrhages may be observed on their surfaces.

Chronic Stage. — The complications, which develop in any given case, largely determine the nature of the lesions observed in this stage. Therefore, various types of pneumonia, enteritis, carditis, hepatitis, etc., may be noted. The lesions having the greatest diagnostic value, when present, include arthritis, gangrenous processes of the skin, ears and tail and a type of endocarditis which sometimes results in the development of a cauliflower-like deposit of fibrin or fibrous tissue, attached to the valve between the left auricle and left ventricle. The liver, spleen, kidneys, lymph glands and other abdominal organs may show chronic inflammatory changes during this stage; in other words, they may be subnormal in size and firm in consistency; deposits of fibrous tissue may roughen their surfaces. The lungs frequently reveal gross lesions in this stage; pin-head to pea-sized hemorrhages may stud their surfaces and edematous infiltration or pneumonia of various types may be observed.

Diagnosis

Since swine erysipelas, in its acute and intermediate stages or forms, is a septicemia, the symptoms and lesions frequently offer insufficient information upon which to differentiate it from other septicemic conditions. The latter include such serious diseases as hog cholera, suipestifer infections, paratyphoid infections, swine influenza, etc.; therefore, even the experienced observer will frequently require laboratory assistance in making a positive diagnosis. Specimens for laboratory examinations, from acute cases, should include a sample of blood and liberal portions of spleen, kidney, liver, and lymph glands; from chronic cases, the heart and, if possible, an enlarged joint should be included.

Several serological and blood tests have been recommended as diagnostic measures, however the present field of their practical usefulness is limited. Positive reactions may denote a previous infection. Positive reactions may not be obtained during the onset of an attack. Also, positive reactions do not eliminate the possibility that hog cholera or some other serious disease exists as a complication in the herd involved, or even in the pigs selected for the test. In spite of these limitations, the test may prove of value in some circumstances.

A field procedure of considerable diagnostic value is the administration of anti-swine erysipelas serum to several pigs which have been ailing not more than two or three days. If the cause of their illness is uncomplicated swine erysipelas, marked improvement usually occurs within 48 hours.

Symptoms and lesions of some value, when present, in distinguishing swine erysipelas from hog cholera are stiff gait, arched back, evidence of pain when handled, higher average temperatures, less mental depression, earlier coloration of skin, infiltrated or gangrenous areas of skin, arthritis, succulent lymph glands, greater gross involvement of spleen, engorged liver, paint brush hemorrhage of gastric serosa, cauliflower heart valve and less extensive petechiation.

A clinical differentiation of acute swine erysipelas from the septicemic types of suipestifer or paratyphoid infections is frequently impossible. Chronic forms of the latter infections are usually characterized by the symptoms and lesions of diphtheritic enteritis, a fluctuating temperature, fluctuating appetite and emaciation.

Control

The isolation of infected swine, the removal of well animals to uninfected soil and the application of rigid sanitary measures are occasionally of value in preventing the spread of this disease. No medicinal treatment of value has yet been discovered.

In Europe, swine erysipelas vaccine and anti-serum are effectively employed as control agents. Since the vaccine contains live organisms, its distribution in the United States is prohibited. Therefore, our only specific weapon is the anti-serum, which is administered in doses of 3cc to 20cc for prophylaxis. For curative purposes, the prophylactic dose is doubled. The spread of the disease is usually checked within 48 to 72 hours following the use of the serum. In handling infected herds, it is a common practice to administer the serum to the sick pigs and to remove the well ones to clean premises; if additional cases develop in the latter group, the remainder of the herd is treated. Some veterinarians return the serum-treated animals to the infected premises with the hope that they will contract sufficient infection there to produce an active and more lasting immunity than would be conferred by the serum alone.

Anti-swine erysipelas serum demonstrates remarkable curative ability when administered during the first three or four days of illness; surprising improvement occurs within 24 to 72 hours in uncomplicated cases. Less benefit is obtained when treatment is delayed until complications have developed. It can be administered in conjunction with anti-hog cholera serum and hog cholera virus, where an uncertain diagnosis warrants that procedure.

* * * *

CAUSES OF HEMORRHAGE INTO MUSCLE

The muscular hemorrhages of slaughtered hogs were formerly thought to have their origin in improper stunning.[84] Hemorrhages are observed when the blow is applied to the posterior part of the skull, instead of to the center of the forehead. In hogs killed by the captive bolt, the hemorrhage occurs when the apparatus is placed too low. If the apparatus is adjusted so that the direction of the projectile is toward the posterior part of the cranial cavity, hemorrhage does not occur. In hogs stunned electrically, muscular hemorrhage is occasioned by the displacement of the electric poles, due to the slight movements of the hog. Since diapedesis takes place 65 seconds after the stimulation of the vasodilators, hemorrhage into the muscles may be prevented in any of the above methods, if the animal is bled immediately after stunning, that is, within 50 seconds; allowing 15 seconds for the stunning operation.

[84] Hertha, K. 1936. Die Verhütung multipler Blutungen in der Muskulatur bei der Schlachtung von Schweinen. *Tierärztl. Rundschau.* 42:935-936.

Restraint and Medication of Swine

By JOHN B. BRYANT,
Mt. Vernon, Iowa

The Author

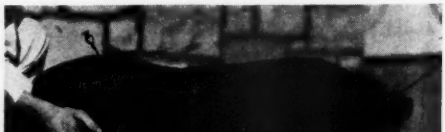
SWINE are capable of practicing defensive and offensive tactics that the cautious clinician must anticipate and respect. A baby pig may inflict dangerous wounds if the teeth are not avoided. Two Eastern Iowa practitioners suffered broken bones recently from impacts with shotes plunging to escape. A sow may be enraged by the squealing consequent upon the handling of her pigs. A boar, in the presence of a sow in estrum, or when cornered, may be combative. The boar, with his sword-like tusks and the enraged sow, rush their enemies, striking with their snouts and slashing and tearing with their teeth. One may fight off a hog by clubbing the snout, but in such an encounter there is personal danger and the chance of damaging a client's animals; hence the wiser course is to shield oneself with a scoop shovel, a metal bushel basket or, preferably, a hurdle. When catching and restraining swine, one must reckon with their brute strength, which is supplemented by their weight and teeth. They compensate swine for what they lack in agility. Swine restraining equipment need not be elaborate. It must be strong for large hogs. The handling must not be unduly rough, lest the animals be injured; a hog's legs are rather easily fractured. Swine that are to be caught should be confined in close quarters, to avoid chasing which is fatiguing to both man and beast.

The Hurdle

The hurdle is the first essential piece of equipment needed to catch swine that are to be restrained. The hurdle that is hinged in the middle is advantageous. Each section should be four to six feet long and three or more feet high. Any strong gate of like dimensions will suffice. Several pigs may be cornered with a hurdle for hand catching, or a large hog may be crowded and caught by reaching over the hurdle and applying the snubbing rope.

The Snubbing Rope

This device requires ten feet of three-eighths inch rope and a strong ring (Fig. 1). In applying it to the crowded hog, it is to be remembered that ringed swine fear any direct approach to the snout. To avoid this fright, open a large loop, with both hands, and drop it over the head. If this is resented, proceed deliberately, and gently rest the loop about the neck until struggling ceases. Then carry the loop forward to the lower snout region and with a gentle upward pull and with side-wise sawing motions the mouth will be forced open. Now drop the loop back of the tushes and tighten it, next remove the hurdle. The assistant then snubs the rope and stands in front of the hog causing it to hang back and submit to vaccination, clipping tusks, abscess incision or oral dosing. Mature



Needle in situ for Injection for Epidural Anesthesia

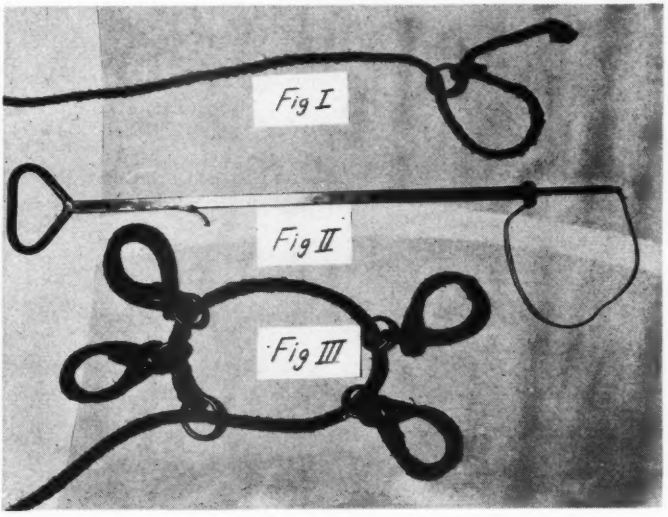
boars may be castrated in this position by snubbing the nose closely to the floor, which prevents squatting. To release the rope, the short end is grasped, the long end loosened and the loop is pulled off the snout.

The Jorgenson Pig Holder

A wire snare, for snout catching of hogs, may be fashioned from a piece of gas pipe and a wire, which accessories are found on many farms. A gratifying improvement on this crude device is found in a machine made instrument and marketed under the name of "The Jorgenson Pig Holder" (Fig. II). This instrument is designed for snaring hogs in an open pen, by approaching the animal; with a quick stroke, the wire snare is looped about the snout and jerked tight. It requires speed and accuracy and a strong man to catch and hold a hog with this instrument. However, if desirable, the snubbing rope may be applied to the hog caught with the instrument after which the desired measures may be practiced or further restraining equipment applied.

The Casting Hobbles

The hobbles (Fig. III) are made of three-eighths inch rope and strong rings. Each hobble is 14 inches over all. The draw-rope is 14 feet long and spliced onto a strong ring. The hobbles are applied, as illustrated, above the fetlocks of the snubbed hog and the draw-rope threaded through the rings and carried to the opposite side on which the hog is to be cast. Now pull on the draw-rope, at the same time kick the hind feet forward and take up the slack, this unbalances the hog. A steady pull on the rope, during the struggling brings all four feet together and the hog rolls over on its side. The legs are then secured with double half hitches and the free end of the rope handed to an assistant who kneels on the hog and steadies him. The animal is now ready for castration, clipping of the tusks, trimming of the claws or other operations, served by this restraint. The hobbles are useful for lashing a hog, stretched on its back, in a trough. A hobble is applied to each leg. A short rope is tied into the ring of a frontleg hobble, passed under the trough and through the ring of the opposite hobble, drawn tight and tied. The hind legs are secured in the same manner. The hobbles are useful, also, in stretching a hog on its side between two posts. The hog is snubbed and the hobbles applied. A long rope is tied in one hind foot hobble, passed back and around the post and threaded through the ring of the opposite hobble. The front



legs are hobbled, in like manner, to a post forward from the hog. Now pull on both ropes, drawing the legs apart, causing the hog to fall, continue to pull until the desired stretch is obtained, then tie the ropes.

Manual Restraint

Manual or hand restraint is employed in castration, in passing worm capsules and in vaccination of pigs of handy weight. For castration the pig is grasped by both hind legs and with the belly to the front is gripped between the knees of the assistant, thus exposing the region for low castration. In administering worm capsules the pig is held up by the front legs. Some farmers grasp the ears instead of the legs. This is objectionable as pigs held by the ears, squeal and struggle more than do pigs held by the legs; besides capsules cannot be passed on squealing, struggling pigs. Capsuling pigs is facilitated by having a "catching pen" and an "observing pen" side by side. About ten pigs are herded into the catching pen, which is lightly sprinkled with shelled corn. The starved pig's mouth is dry and the munching of corn starts the saliva and lubricates the passages. After the capsule is dropped over the base of the tongue, in the usual manner, the pig is set down in the observing pen, when corn is also scattered. As soon as the pig starts "cracking" corn, the swallowing of the capsule is assured. If corn is refused, the pig is to be watched, for it is quite likely to cough up the capsule, in which case it is to be retreated.

Vaccination methods, both as to restraint and serum-virus administration, vary with operators and with conditions. The following methods are adaptable to a wide range of conditions and require the minimum of equipment. The trough is not used.

The operator wears a carpenter's apron, for carrying a disinfectant bottle and bottles of virus, if advisable. A quart bag hung about the neck and connected with an automatic syringe, in one hand, is used for the serum, and a 40cc syringe for the virus is carried in the other hand. Thus equipped one may immunize approximately 50 pigs without going to his stock of supplies which for safety purposes should not be too close to the scene of activity. Pigs, up to 100 pounds, are held up by the hind legs and gripped between the knees of the assistant. The serum is given intraperitoneally, and the virus, deep into the ham. The assistant should stand with his back to a gate or door which is opened for the passage of the pig when it is released. Pigs that are too heavy for this restraint may be set up on their haunches and vaccinated in the

Convenient Trough for Vaccinating Swine

axillary and inguinal spaces, or they may be caught with the "pig holder" and injected back of the ears or fore legs. Such restraint will answer when a few shotes are to be treated and but one man is available to hold them.

The preferred method of restraining heavy shotes requires two men; one grasps a hind leg and the other a front leg, on the same side; then the shote is thrown on its side on the floor. The man holding the front leg places a foot on the jowls and the man holding the hind leg places a foot on the under hind leg. In this position the axillary and inguinal spaces are exposed for injection. The hogs should be cast with the head next to a door or gate, which is to be opened and through which the animals pass when released. This method of restraint does not require lifting the hog, and two legs are held instead of four as are required in the trough method. Large hogs and especially pregnant sows are to be crowded carefully with a hurdle, caught and held on the snubbing rope, while the injections are to be made back of the ears and forelegs.

Bacterin Administration

A convenient method, for administering bacterins, consists in closely crowding four or five animals, with the hurdle, and injecting the bacterin into the neck muscles. Before attempting to insert the needle, the free left hand, knuckles down, is placed on the hog's neck. As soon as the reaction to this touch subsides, the needle, attached to the syringe and guided by the left hand, may be thrust through the heavy skin. This procedure scarcely causes a flinch.

The Stomach Tube

Dr. C. E. Juhl, Osage, Iowa, is author of an article on stomach-tube medication of swine, that was printed in the April, 1923 number of the *Journal of the A. V. M. A.* and from which the following is abstracted and revised according to changes adopted since that time.

The equipment consists of about 15 inches of rubber horse catheter, fitted with an adapter, a 10 inch metal tube, curved at one end and a syringe.

In passing the tube, if it enters the trachea, the resisting point corresponds, in distance, to that of the xiphoid cartilage; the pig will cough, or attempt to cough, and display uneasiness.

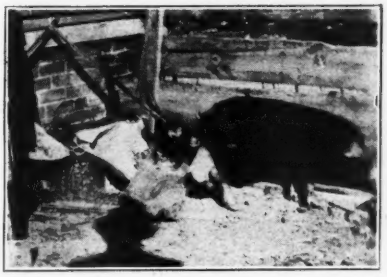
For passage of the tube, the pig is held on its back in a trough. The rounded end of the catheter is inserted in the straight end of the pipe and the curved end is passed over the heavy part of the tongue. One hand now tightly clamps the jaws on the pipe and extends the head, while the other hand manipulates the tube. When the tube has passed far enough to ensure that it is in the esophagus, the syringe, containing the medicament, is connected with the adapter and its content injected through the tube.

* * * *

Intermediate Host of Lungworms

The larvae of the embryonated metastrongylide eggs hatch in moist soil.[44] Angleworms serve as intermediary hosts. In them the larvae undergo two sheddings of their skin. When the angleworms are ingested by pigs the parasites are liberated in the intestinal tract. Migrating to the mesenterial lymph-nodes they shed their integument again, emerging into their fifth stage as male and female worms. Twenty-four days later sexually mature females may be found in the lungs, while the tracheal mucosa may contain embryonated eggs. For experimental purposes the guinea pig proves to be a suitable animal.

[44] Matoff, K. 1936. Einige Fragen aus der Biologie der Schweinelungenwürmer *Metastrongylus elongatus* und *Choerostrongylus pudendotectus*. *Tierärztl. Rundschau.* 42:597-600.



Epidural Anesthesia in Swine

By E. R. FRANK, Manhattan, Kansas,
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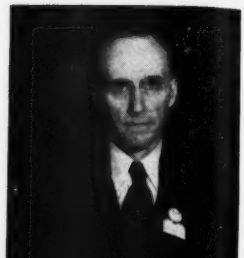


The Author

EPIDURAL anesthesia is particularly valuable for swine because of the ease of application. If reasonably good care and judgment are exercised in injecting the anesthetic solution no undesirable after effects should occur. Because of the comparatively short spinal column in swine it is important not to elevate the posterior portion of the body after the injection of the anesthetic solution. If the posterior parts are elevated there is danger that the anesthetic solution may gravitate too far forward and affect some of the vital nerve centers.

PROCAINE hydrochloride is the anesthetic of choice for epidural anesthesia. It is comparatively non-toxic with a wide margin of safety. The ideal solvent for the procaine hydrochloride is a 0.7% solution of sodium chloride. This is because the procaine increases the salt concentration and the solution becomes hypertonic, if a physiological salt solution (0.85%) is used for the solvent, thus delaying absorption. If a crystal of thymol is dropped into the solution it will prevent the growth of molds which often develop in solutions of procaine hydrochloride. In this way stock solutions of the anesthetic may be prepared beforehand for use when needed.

For injecting the anesthetic solution a glass syringe is desirable as the plunger works easily and without friction. It is important to know how much pressure is being used to inject the solution as this is the surest guide as to whether the needle is in the vertebral canal. If the needle is properly placed, no pressure is necessary to make the injection.

The area at the site of the insertion of the needle should be thoroughly cleansed with an efficient skin antiseptic.

In swine the needle is inserted in the rather wide space between the last lumbar vertebra and the sacrum. The side to insert the needle in the skin is determined by first palpating for the anterior borders of the wings of the ilii. Then draw an imaginary line backwards two and one-half inches on the median line. At this point and exactly on the median line the needle is inserted in a downward and forward direction. The depth the needle will have to be inserted will depend upon the size and condition of the pig. For a pig weighing sixty pounds the needle will have to be inserted about one and one-half inches and for a 125-pound gilt a three inch needle is necessary. In large sows many times it is necessary to insert the needle four or four and one-half inches.

The operator can usually determine when the needle enters the vertebral canal as the pig will flinch or squeal. If difficulty is encountered in finding the space the point of the needle can be directed down the posterior surface of the last lumbar spine. Another method is to direct it along the rather smooth anterior surface of the sacrum to the opening between the last lumbar vertebra and the sacrum.

The standard for determining the amount of local anesthetic to inject in swine is one cubic centimeter of a two per cent solution of procaine for each ten pounds of body weight. However, for a scirrhous cord in a sixty or seventy pound pig five cubic centimeters are usually sufficient.

To perform a cesarean section in a two hundred and twenty-five pound gilt twenty cubic centimeters are usually sufficient.

For less painful operations, such as the examination of the genital tract in a case of dystocia, a 1% solution is strong enough.

Obstetrics in Swine

By DONALD D. BAKER,
Wabash, Indiana

SWINE obstetrics has, by reason of the economical situation, been very much in the background for several years. The future promises more swine practice. Requests to play the rôle of midwife at the farrowing pen will again be among the calls of the veterinarian. Various expressions have been voiced about such service with a general sentiment of disgust, that this work should be popular with anyone. There are many phases of veterinary practice that are not popular with every practitioner; however, many strive to serve well their clients' needs, in the matter of animal disease control, whatever they may be and the occasional call to aid a farrowing sow is included in the business.

It may grate on the nerves to play midwife to a farrowing sow for a period of several hours, wading the mud to her pen, creeping into an individual house, knowing that this one will not be productive of much revenue, while possibly a more lucrative call may thus be lost. However, the esthetic stress may be obviated by a practical way of handling such cases.

NEARLY all cases of dystocia in swine can be cared for best at the hospital. The facilities for transporting a sow to the veterinary hospital are much better than the facilities for swine obstetrics on the average farm.

When one recalls the hours required for a single case of long-drawn out parturition, the repeated examinations required, the careful instrumentation and assistance necessary, it stands to reason that the case should be handled between calls or mingled with other business at the office. A sow needs more time for a difficult parturition than a veterinarian can afford to give at a price the owner can afford to pay, when other calls demand his attention. The sow that farrows close at hand in the hospital, or in a nearby pen, can be given more attention. Examinations need not be so frequent and can be made less irritating to the lining membranes of the genitalia. More time is available to ascertain the fact that the sow is through delivery and needs no more assistance. The grand finale is hard to determine and if announced too soon, in order to get away, all effort is apt to be wasted. Often a sow is hauled into the office to be vaccinated, and the same may just as well be required in obstetrics for weightier reasons.

MEDICATION in swine obstetrics has not been developed to the point of being truly scientific. Cleaning the external genitalia, thoroughly lubricating the instruments and arm is about all that can be conscientiously required. Pituitrin does not seem to give beneficial results. However, hypodermic injections tend to satisfy the owner and add to the very simple procedure of snaking out the pigs a much-needed scientific touch.

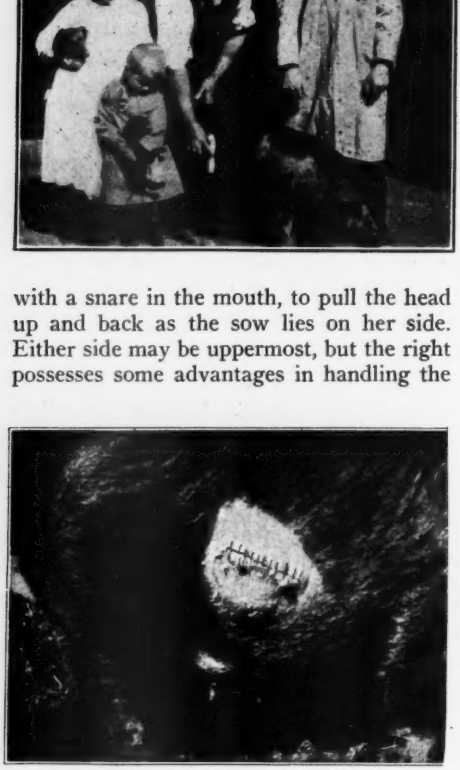
To be certain that parturition is over requires time and observation, and an uncertain case should not be left without bringing to the attention of the farmer that more pigs may yet arrive.

Cesarean Section

The cesarean operation offers a surgical method of relieving swine dystocia. Where the sow is small or deformed in the hips, or presenting a prolapsed cervix, or when labor pains are missing, there is, as a rule, little chance for success of manual assistance in delivery. The cesarean operation, therefore, would seem the logical procedure.

CESAREAN section in any animal is major surgery. The sow should be brought to the hospital for this operation. It cheapens the work and adds to the hazards to perform this operation in the hog pen. Nevertheless for various reasons it must be undertaken on the farm on occasion. Restraint in such cases should vary to suit the conditions. A simple restraint consists in stretching and tying the legs forward and backward and tying the head

with a snare in the mouth, to pull the head up and back as the sow lies on her side. Either side may be uppermost, but the right possesses some advantages in handling the



The Skin incision is closed with interrupted linen sutures

uterus when exposed. This same restraint when used on a raised platform or gate, will enable the operator to stand instead of squatting or sitting which is necessary when the sow is cast on the floor. The squatting and sitting position becomes very tiresome to the operator. A little trouble taken to tie the sow to a gate, and then raise the latter on a couple of boxes, provides ease and comfort for the operator and permits a better technique.

When a gate is used, the legs need not be extended forward and backward to any excessive degree, but may be secured in a more natural position with a tie around the shoulders to hold the body to the gate and to prevent sliding toward the feet. If the latter should happen, the feet invariably become loose giving them too much chance for jerking so that new ties have to be made. It is well to tie a rope to each leg before throwing as trying to stretch a leg and then tying a rope to it usually results in it being too loose.

THE anesthesia can be varied from local anesthesia to the various methods of general anesthesia. Ether anesthesia given with a sponge and cone is safe and easily controlled. The disadvantage is the need of an assistant to continue the administration of ether during the operation. A cotton sponge and an old sock may be used for administering ether. That may be the only restraint necessary where the animal is snared or held until completely anesthetized. The owner may attend to the anesthesia when the animal is completely under. Local anesthesia alone, using 20 to 30cc of a 2% solution of procaine, superficially and deep, provides a very good desensitizing effect and is to be preferred to the operation without anesthesia or narcosis. Internal administration of chloral hydrate or anesthesia given intravenously or orally requires too wide a safety margin to be ideal, yet they are beneficial for basal narcosis. Further, they tend to narcotize the pigs for several hours which may be detrimental.

THE skin incision should be long and include the cutaneous muscle layer. The heavier oblique and transverse muscles are divided, taking each at the center of the incision and tearing them in the direction of their muscle fibers. This gives a criss cross opening that closes spontaneously under natural tension.

Before opening the abdominal peritoneum, a sterile cloth or rubber sheet with a center opening the size of the incision is placed over the side of the sow and secured to the skin incision with forceps on each side. The upper corners of the cloth may be clamped to the hair.

USUALLY considerable loose fat lies on the peritoneum. It can be clipped away and the peritoneum incised dorsoventrally with a blunt-pointed scalpel. The hand and the arm should be sponged and inserted into the abdominal cavity, tracing a horn of the uterus to the anterior extremity and drawing it to the exterior, grasping each fetus in the horn to pull it through the abdominal incision. When the appearance of the uterus indicates decomposed, gaseous fetuses, it may be well to withdraw both horns before opening the uterus. This eliminates having to insert the hand into the abdominal cavity after it has become contaminated by the debris from the uterus. In most cases the uterine contents are practically sterile.

The horn is incised on the anterior surface with a large incision seven to eight inches in length, extending forward from the bifurcation. A large incision is important as the uterus usually contracts somewhat, and in removing a fetus a tear in the incision follows the transverse muscle fibers and makes a very nasty incision to suture. To prevent a transverse tear is one of the important points to heed.

THE fetuses are removed as quickly as possible, forcing them individually backward a short distance, keeping them all moving toward the incision to prevent the uterus from contracting. Unless all the fetuses are moved along together the contraction of the horn makes the last fetuses difficult to work along the horn. There seems to be no objection to leaving the fetal membranes to be discharged naturally.

If considerable decomposition has taken place, the abdominal opening should be protected by large cotton sponges.

WHEN the horns have been emptied, the anterior portions can be replaced to prevent drying of the tissues. The surface of the exposed portion of the uterus should be kept moist. One incision in the uterus should be sufficient in order to economize on time in suturing. The tone of the uterus varies in different animals and the time required to remove the fetuses is dependent upon the tone and contractions. The contractions influence also the speed in suturing. A flabby uterus folds in much faster than one that is thick and firm.

The peritoneum and the deepest or transverse muscle layer are sutured with two or three catgut sutures. The two oblique muscles are drawn together with but one suture. The skin is sutured with heavy linen using an interrupted series.

The type of suture material seems of little importance as long as it does not dissolve too readily. Plain catgut possesses this latter fault, allowing the uterus to open.

A round needle does not cut the uterine wall to the extent that a sharp edged needle cuts it. The cloth for operating can be prepared in advance by dipping squares of muslin in melted paraffin containing 2% phenol. These are folded and wrapped to a convenient size. A satisfactory way to sterilize scalpels and sharp edged instruments, that do not retain an edge through the process of boiling, is to pass them through a flame.

An accurate prognosis in a cesarean section is very difficult. Some cases even in which decomposition is marked, recover nicely, other cases succumb unexpectedly.

Swine Castration

By DONALD D. BAKER,
Wabash, Indiana

This discussion deals only with the castration of boars. The spaying of sows was listed in the older text books under the heading of Castration but this operation has become obsolete in this country, due to the early age at which hogs are marketed.

Generally speaking, castration of swine by a veterinarian may not be an economic procedure. Many swine raisers have very good success doing their own pig castrating. Some few have had discouraging experiences that have caused them to have a veterinarian do the castrating. Some of the younger swine raisers seem inclined to depend on the veterinarian for this work. To perform the operation without untoward after effects is, of course, the aim of one paid for such work and the expectation of the one paying for it. This requires an improvement over the usual farmer's method of castrating. The two things essential to improve over the farmer method is a large, low incision and the covered operation. These two points are in reality the paramount features upon which good results depend. When the castration of pigs is being planned with an owner, it is well to advise a little preparation of the animals. Shotes of the usual size should be sorted and taken off feed over night; at least two feeds should be missed. This is done both for the comfort of the animal and the convenience of the veterinarian. Handling animals on full feed is a waste of feed. The violent exercise and struggling of the pigs, incident to handling interferes with digestion.

Animals penned up on a clean straw bed should be in good shape for castration, as far as cleanliness is concerned. About the only precaution against infection taken in Indiana, as far as the writer has learned, is to keep the knife clean and sharp. The scrotum is not washed or swabbed with antiseptics, but kept dry so that a firm hold can be taken of the skin, well below the scrotum, to strech it for the incision. This may not be educating the farmer in the dependence of antiseptics which they often think should be used but the result of this technique should prove that they are not indicated.

The technique of making a low incision is as follows: The loose skin, well down below the scrotum, is grasped between the fingers and palm of the hand to draw it downward to stretch it tense. The two incisions are made, drawing the knife upward toward the center of each testicle. This method does not cut forcibly against the testicles and therefore does not open the tunic. A little pressure is required to squeeze the tunic and testicle out through the opening when they are grasped with either hand to pull them free, then the cord and tunic are all jerked out. The same method is used in aged boars, but with more care in making the incisions as part of the cutting is made against the large testicles.

Feed on large boars should be restricted afterwards for several days to keep down swelling. Large boars usually have little opportunity for exercise.

For small pigs, under 50 or 60 pounds, the restraint may be similar to that used in vaccinating, by the intraperitoneal method; that is, the assistant holds the pig up by the hind leg with the abdomen toward the operator. One incision is made beginning with a fold of skin in the lower portion of the scrotal sac and extending downward toward the abdomen for about two inches. The cords are both hooked out of the same incision with the index finger. The testicle, with the tunic, is pulled out of the scrotum covered as is done in larger boars. However, this incision is so low that tensing and cutting off the cords seems better than breaking it by pulling. Care must be taken that no inguinal hernias pass unnoticed, as holding pigs in this fashion practically removes all visible signs of rupture.

The castration of small pigs may be expedient where serious soil infection pre-

sents a hazard, as the small pigs can be confined to clean quarters in a building, which would be impractical for larger shotes. The knife should be kept sharp and cleaned with antiseptic cotton after each operation. A point generally practiced is not to castrate at vaccinating time, but about three weeks later. It seems that almost any wound proves fatal, close to vaccinating time.

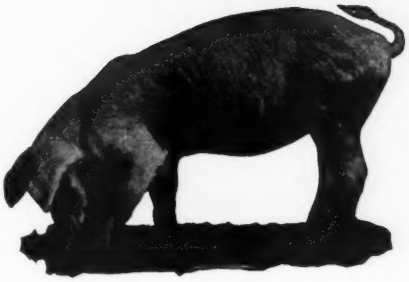
Castrating Ruptured Pigs and Ridglings

About the only point to stress in operating upon pigs having scrotal ruptures or any kind of rupture is the matter of feed. Pigs should be thoroughly starved out on

Testicle of Cryptorchid boar. G testes; H. globus major; I, globus minor; J, body of epididymis; K, spermatic cord.—After White.

a dry floor for 36 hours. Few farmers know what starving out a pig means. Most of them think that withdrawing one feed is about all they can stand. Many times they pen them where they root in manure and are well filled when the time comes for operating. The tissues that we depend on for holding a rupture are so very thin that the less internal pressure there is the better the outcome.

An owner will go to considerable trouble and expense to have a pig operated upon. The amount of feed before and after should be given as much consideration as the operation. Bulky feeds as slop and grass should not be allowed afterward. An ear of corn and water at each feed for four or five days has done much to favor the successful outcome of our rupture operations.



In castrating ridgling boars the animal is tied to a ladder or table in lateral recumbency, with the head inclined downward. Ether or procaine is used for anesthesia. The side is shaved and disinfected. An incision three to four inches long is made close to the hip. The muscles are divided as in a cesarean section. The peritoneal cavity is opened, the testicles located and removed. They are usually found in the inguinal region, but occasionally have descended and are not developed. One suture down through the skin and through the edge of each muscle, picking up the edges of the peritoneum and back on the other side of the incision in the same manner, will be sufficient to close the opening. The muscles, being divided in the direction of their fibers, have a tendency to close automatically so that one suture suffices.

Meat packers are much in favor of this operation.

Anemia of Suckling Pigs

By CHARLES E. SALSBERY,
Kansas City, Missouri

An anemia of baby pigs was first described by English workers in 1923. It has since been observed frequently by others in a number of different countries, notably in the United States. Losses in the United States due to this disease are not definitely known, but there is substantial evidence that they are considerable. The losses must be accounted for not alone by the number that die, but also by the lack of proper development in many others. It is significant that nearly all of these losses occur among litters that are farrowed during the winter or early spring and it was observed in Germany that these losses became particularly severe after the introduction of the modern hog-house.

Cause

The lack of sufficient blood forming elements, notably copper and iron, appears to be the exciting cause. A deficiency of these elements in the milk of the sow, and the inability to supplement it by access to other sources, such as the soil, apparently accounts for the presence of the trouble in all cases. The writer has observed the disease in litters that were quartered with the sow in pens where there was no access to the soil or any other material from which the necessary amounts of copper and iron were available. Sows with suckling pigs kept in pens with concrete floors were fed on a ration composed of ground yellow corn, barley and alfalfa meal. Development of the pigs was normal during the first two to four weeks. At this time, or soon afterwards, symptoms of unthriftiness became apparent, and there followed progressively increasing evidence of the disease known as anemia. Other litters kept under the same conditions, except that there was access to soil, developed normally and at weaning time showed no signs of the disease. Similar observations by others quite conclusively established the lack of proper amounts of copper and iron as the cause of anemia in suckling pigs.

Symptoms

A very definite syndrome of symptoms characterizes this disease of young pigs. In spite of an abundance of milk from the sow, pigs that have thrived on it for a number of weeks begin to exhibit signs of unthriftiness, the first evidence of which is a roughness of the hair. Instead of remaining sleek and smooth, the hair becomes dull and coarse and stands erect. A listless attitude develops, becoming more marked as the disease progresses. Other signs of the sickness are drooping of the head and upper eye lids. The ears and tails hang limply; this is particularly noticeable, since in healthy pigs the ears are erect and the tails have the twist which indicates health and thriftiness. Anasarca develops in the region of the neck, shoulders and limbs. Careful examination reveals a subcutaneous edema which gives the appearance of plumpness, but the skin soon becomes wrinkled, dry and scaly, indicating that the apparent fatness and plumpness do not actually mean that the pigs are gaining in weight. Auscultation and percussion will show that the body cavities contain excessive amounts of fluid. Characteristic thumpy movements of the flanks indicate abnormal respiration. In the more advanced cases paleness of the visible mucous membrances is a definite exteriorization of anemia.

Pathology

At autopsy the bodies of anemic pigs show usually a surprisingly good state of nourishment. This is a point worth remembering since it is in such contrast to many other diseases of similar duration, but in which cachexia and general loss of physical condition are evident. The body cavities contain large quantities of clear fluid. The heart is dilated and enlarged and appears pale and soft. The lungs are edematous and often collapsed. The heart and lung conditions are probably respon-

sible for the thumpy breathing, noted as a common symptom. The liver is enlarged and mottled and on section has an oily appearance. All organs, muscle and connective tissues are anemic, having the so-called "washed out" appearance. The blood is thin and watery.

Treatment

Since it is known that this disease is due to deficiency of copper and iron it is a simple matter to supplement the milk ration with these elements. It would seem that feeding these to the sow might correct the condition but such has not proved to be true. Feeding these minerals to sows during the gestation and lactation periods has not altered the condition in the pigs, since the pigs farrowed and suckled by such sows come down with the disease the same as pigs from sows not so treated. Hence, it is obvious that supplementing the ration of the pig with copper and iron is necessary.

The quantity of these supplements needed is small and it is not necessary to feed copper as such, because commercial iron salts as purchased on the market contain sufficient copper. Commercial iron sulphate (ferric) is a satisfactory iron salt to use. Ordinary copperas may also be used but it must be soluble in water. Supplementing the sow's milk may be accomplished in various ways.

1. Dissolve 3.6 ounces of the iron salt in five quarts of water. Give to each pig daily as a drench one teaspoonful of this solution.

2. Add the iron salt to the sow's feed and distribute so it will be available to the pigs. One-tenth of a pound of iron sulphate (ferric) mixed with 100 pounds ground grain is a suitable mixture.

3. One-tenth pound of the salt may be added to 100 pounds of skim milk and placed in a trough from which the pigs may eat.

4. Allowing the sows to farrow where soil and vegetation is available and accessible to the pigs prevents the disease. If farrowed in houses with concrete floors the pigs may be supplied with soil by putting it into the pen. Experimental tests have shown that this method is very satisfactory.

Strangles in Hogs

Hutyra and Marek[1] describe under this title an outbreak observed by Starcovici in Roumania in 1898. They say that it is "an affection in young hogs in the course of which the submaxillary and subparotid lymph glands developed an inflammatory swelling and later suppurated." The disease lasted several weeks but nearly all pigs recovered. "Bipolar bacilli and streptococci were found. . . . Treatment consisted in opening and subsequent washing of the abscesses."

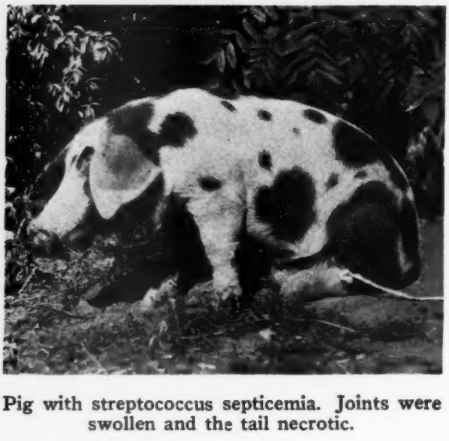
The attention of this author was brought to a similar disease September 11, 1936, by Dr. R. E. Tinsman of Julesburg, Colorado.

Strangles pig showing swollen jowl.

The condition developed in a lot of 30 pigs farrowed about March 1 and remaining in good health until September 9. On that date the owner noticed that some of the pigs were coughing and wheezing. The next day he called Doctor Tinsman who made a postmortem examination of one of the pigs that had died during the day. He found several abscesses in the region of the throat, the pus in which was under considerable pressure. He describes the pus

[1] Contribution from the Section of Pathology and Bacteriology of the Colorado Agricultural Experiment Station.

as of a yellow to greenish color and without odor. At this time all but four or five of the pigs showed a swelling of the throat. The following day two of the diseased pigs were delivered to our laboratory. They did not appear greatly depressed and showed no rise in temperature. Both pigs were slaughtered and both showed numerous abscesses from the size of a walnut to the



Pig with streptococcus septicemia. Joints were swollen and the tail necrotic.

size of a baseball in the region of the throat. One showed smaller abscesses in the superficial inguinal lymph glands.

Cultures obtained from both pigs yielded an uncontaminated hemolytic streptococcus that produced acid from dextrose, sucrose, mannitol, levulose, sorbitol, maltose and dextrin but not from lactose, dulcitol, salicin, raffinose, mannose, glycerol, arabinose, inulin, inositol, xylose or rhamnose.

The remainder of the pigs were treated surgically, the pus being drained and the cavities washed out. Three more died but by October 6 most of the others had recovered.

Since this was the first time this disease had been brought to our attention some research of the literature was made and inquiry made of men of experience in swine diseases. Several reported they had seen the disease and Dr. A. T. Kinsley stated that he had isolated streptococci from such cases. The reference at the opening of this article was however the only recorded outbreak that could be found. European authors frequently attribute disease in pigs to streptococci but for the most part they deal with septicemia of sucklings, a disease which is also prevalent in this country.

Willems[2] reports on 368 laboratory examinations on porcine material 33% of which revealed streptococci. He expresses the belief that 50% of the deaths in pigs in France is due to these organisms.

About two years ago the writer isolated a hemolytic streptoccus from a pig showing symptoms of arthritis. This pig was from a lot where the mortality had been heavy within the first 10 days of life. It was believed that infection had occurred through the umbilicus. No abscesses, however, developed in that outbreak.

Doctor Kinsley says that abscesses of the cervical glands may sometimes result from injury caused by foxtail or barley beards. No such explanation could be given in this case. Neither did the disease seem to be secondary to any other malady. The pigs had been vaccinated successfully in May.

The term "strangles" is used here following the lead of Hutyra and Marek altho it is evident that the streptococcus is not the same as that isolated from horses.

References:

1. Hutyra and Marek, Third Am. Ed. 1:482.
2. Willems, R. *Ann. Méd. Vét.* 78-105. Abstract in Vet. Bul. 4-301.

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Fort Collins, Colorado.

* * * *

Toxic Effect of Cod Liver Oil

Following the administration of deteriorated cod liver oil to several droves of pigs, several hundred fatalities were encountered.[31] Feeding experiments upon young pigs confirmed the toxicity of the cod liver oil. Numerous, carefully conducted histological, microchemical and analytical experiments make it appear that unsatiated fatty accids were responsible for the toxic effect.

[31] Bolle, W. *Arch. Tierheilk.* 70:99-121.

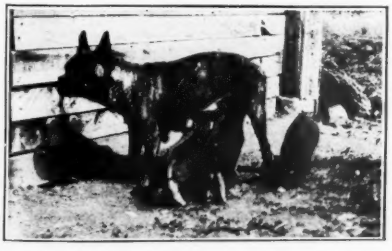
Hairless Pigs: Goiter

By CHARLES E. SALSBERY,
Kansas City, Missouri

This disease is not widely distributed throughout the hog belt, but occurs frequently in some sections. In some of the northern states and Canada hog breeders experience considerable losses among spring litters during certain years. The condition is commonly known as "hairless pigs" and has been investigated quite extensively in Montana.

Certain peculiarities in connection with its occurrence are not easily explained. For instance, it has been noted that the removal of brood sows from certain lots in which hairless pigs were being farrowed, to other lots resulted in farrowing normal pigs. Also the presence of the disease in any locality does not mean that all litters in that area will be affected. It has been observed that even on adjacent farms losses may occur on some and not on others. Furthermore, even on the same farm and in the same feed lots only a few of the sows may produce hairless pigs while others may not. One farrowing of such pigs by certain sows does not necessarily mean that subsequent litters will be hairless.

Investigation of the trouble in Montana indicated that confinement in pens or feed lots is not a factor in producing hairless pigs since it may occur among litters farrowed by sows provided with unlimited range. These investigations further indicated that neither variations in feed nor other environment influence the incidence of the disease.



Inasmuch as an abnormal condition of the thyroid gland is present in these cases, it is believed that a lack of iodine in the diet of the sows during gestation is responsible for the disease. Enlargement of the thyroid resembling ordinary goiter was found to be present in nearly all cases. This is the indication that a deficiency of iodine is the cause of the trouble.

The chief symptom, as the name implies, is the absence of hair on the farrowed pigs. In some cases there may be thin patches of hair but often alopecia is complete. Other outstanding symptoms are absent. There may be slight enlargement of the head and neck and the skin over these areas may be thickened and wrinkled.

Since a lack of iodine is commonly regarded as the cause of goiter it would appear that a diet deficient in this element might reasonably be suspected as the cause, and therefore of dietary origin.

Furthermore, addition of iodine to the ration of the sow during gestation is effective in preventing the condition. One to two grains of potassium iodide added to the daily ration of the sow during the period of gestation produces good results.

Scour of Pigs

By C. C. HASTINGS,
Williamsville, Illinois

Of the many ailments of new born pigs scour probably accounts for a larger percentage of mortality than any other disease. It is seen more or less frequently on all farms where pigs are farrowed, and is constantly in the mind of every swine raiser. The losses vary from slight to as much as 70% of the pig crop.

In handling pig scour it is necessary for the practitioner to recognize two distinct types of the disease, with some variations and subdivisions of each; namely, (1) scour due to prenatal infections, and (2) scour caused by postnatal conditions.

Scour resulting from infection before birth is usually, if not always, a sequel to some febrile disease, such as influenza, that has affected the dam within the previous year. This type of the disease is ordinarily associated with some form of abortion and is more prevalent in pigs farrowed by gilts than in litters of aged sows. It develops during the first few days of life and may even be present at birth. It is not uncommon for a fetus to be expelled on account of death from scour *in utero*. When this occurs the placental fluid is intermixed with fecal matter.

In this form of the disease the mortality rate is very high and treatment unsatisfactory. Swine raisers should be advised to avoid the use of breeding animals known to be diseased or that have recently recovered from a febrile infection. When this rule is adhered to the losses from this type of scour will be reduced to the minimum.

Scour of postnatal origin develops after the pigs are a few days to several weeks old. Its origin depends upon a variety of conditions that tend to lower the natural resistance of the young animals; such as dietary disturbances, exposure, insanitary environment, poor housing, congenital weakness, and improper care of the sow.

Since the pigs' diet is principally milk its composition must have been changed to cause the affection. This may happen from over-feeding the sow the first few days after farrowing, especially on corn or other concentrates. Overfeeding with a properly balanced ration will increase the milk flow sufficiently in some sows to cause their pigs to scour. It may be caused by mastitis or by the elimination of toxins through the milk. Certain chemicals and saline purgatives found in some commercial mineral mixtures are eliminated in part through the milk and may cause the pigs to scour. Pigs nursing sows that have access to mud holes and filth may consume sufficient foreign material from the teats to produce intestinal irritation. Chilling has a harmful effect on small pigs. Congenital weakness predisposes to diarrhea. Underfeeding the sow during gestation may cause weak pigs that are prone to scour. Pigs that are closely housed will often become constipated, thus permitting the normal intestinal bacteria to multiply to an unusual extent. The irritating products of fermentation and putrefaction cause increased peristalsis and excessive secretion of fluid into the intestinal canal resulting in diarrhea that may be followed by inflammation of the intestines. The disintegration of the intestinal contents usually produces an acid reaction that further augments intestinal peristalsis.

The colon bacillus, which is a normal inhabitant of the intestinal tract, may under abnormal conditions become pathogenic and produce disease in the intestinal canal. In the latter case the bedding and feed materials become contaminated with bowel discharges and a large part of the herd may thus become infected.

Symptoms.—At first there is constipation, followed by diarrhea. The bowel discharges are yellowish and of a pasty consistency, later changing to gray or slate color, and then to white. Sometimes they are foamy and contain partly digested milk or solid food. The temperature is slightly higher at first and then returns to normal. The pigs have a tucked-up appearance and evidence pain when moved. There is rapid emaciation. Prostration is marked. The

animals lie in the bed and refuse to suck.

The course of the disease is ordinarily five to seven days. The termination may be recovery, death or chronic enteritis due to secondary infections. Many herds affected with necrotic enteritis have a history of pig scour acquired when the pigs were only a few days of age.

Autopsy.—Usually there are but slight pathological changes in the tissues. The intestinal mucosa may be swollen and show some irritation. Occasionally a severe enteritis is found, with the lumen of the bowels containing blood.

Treatment.—Since the majority of cases is caused by dietary disturbances the first requisite is to correct the feed of the sows. The parturient sow should receive nothing but water the first day after farrowing. A light feed can be given the second day and thereafter gradually increased. The most successful swine raisers allow sows nothing but dry oats for one or two days before farrowing and for four days after farrowing.

When the pigs start to scour the sows should be kept entirely off feed for 24 hours to reduce the milk flow. Then a light ration of oats should be provided until the condition is corrected. This reduces the milk flow and changes its character. Corn should never be fed to sows while the pigs are scouring. Overfeeding sows with corn is a frequent cause of this trouble. Clean, warm quarters should be provided, and any insanitary conditions present corrected. Houses should be cleaned daily to protect the well members of the herd. If the affected pigs are old enough to eat solid food they should be given a saline purgative. Sodium sulphate ranks among the best. Follow the purgative with copper sulphate solution, thirty grains to each gallon of drinking water. Allow no other water. Withhold all solid food and give nothing but a thin slop. Oats are particularly contra-indicated in these cases on account of the danger of the hulls penetrating the diseased part of the intestines.

Syssomian Monster

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Food Poisoning in Swine

The following indicates difficulties encountered by practitioners:

History.—There were two lots of 15 to 30-pound pigs on the same farm. These two lots were fed and watered in the same way by the same attendant and there was no difference in the two lots. The pigs in both lots were observed at 10 a.m. and all were normal. At 8 p.m., that is 10 hours later, the pigs in one lot were normal, but four pigs in the other lot were down and unable to rise and two others were very weak and wabbly in the hind-quarters. An hour later, two were dead, and at 7 a.m. the next morning five were dead and nine others were affected. From 7 a.m. until 1 p.m. three more died and by 8 p.m. a total of 13 were dead.

Symptoms.—Wabbling gait, paresis of the hind-quarters, comatosis in some of the pigs. Temperature ranged from 96° to 102°F. There was no vomiting or diarrhea or other evidence of digestive derangement.

Post Mortem.—The kidneys were anemic, slightly friable, and petechiated; the bladder empty and ureters apparently constricted. A thick gelatinous mass filled the entire pelvic cavity and extended two to three inches anterior to the kidneys.

Diagnosis.—Poisoning of dietary origin. Comments from readers of VETERINARY MEDICINE will be appreciated as to diagnosis and what poison, drug or substance produce symptoms and lesions above described.—*W. K. Y., Indiana.*

Rhinitis of Pigs (Bull Nose)

By C. C. HASTINGS,
Williamsville, Illinois

RHINITIS is an infectious nasal disease of pigs from six weeks to eight months of age, characterized by an inflammation of the nasal and ethmoid mucosa, and distortion of the nasal bones.

It occurs either sporadicly or as a herd infection, usually the former. Seldom are there more than 10% of the herd infected. It makes its appearance on the same premises for several successive years, unless sanitary conditions are materially improved, in which case the disease is entirely eliminated, or at least its incidence greatly reduced. Where hygienic conditions are bad the addition of an infected pig to a healthy herd will often infect several members of the herd. On the other hand if an infected pig is added to a herd living in good sanitary environment, usually few, if any, members of the herd contract the disease.

Etiology.—The cause of this disease is not entirely clear. It seems that several factors, working together, are necessary to produce rhinitis and bull nose in a herd of pigs. Apparently the most important is insanitary surroundings. A mechanical abrasion seems necessary for the infective agent, which is probably filth borne, to gain entrance. I doubt if it is ever transmitted directly from one pig to another. It is usually seen in herds occupying lots that have been used for hogs over a period of years. Even then, it is far more prevalent in wet seasons. When mud and filth enter the nasal cavities there is always the danger that injury to the mucosa will open up avenues for infection to gain entrance. Quite often the original focus is around the teeth, caused by sharp objects such as coarse hay or bedding, ice, frozen corn or other harsh grains injuring the gums. It is frequently seen in herds where the black tusks of a few-days-old pigs have been clipped with a pair of nippers by an ill-advised herdsman. This malpractice permits the infection to enter the tooth alveolus and to spread to the sinuses and the nasal cavity. This is a very frequent chain of events that should never be overlooked.

The extremely close association of rhinitis with scirrhous cord in many herds leads one to believe that the two diseases are often, if not always, caused by the same organism. In one herd where bull nose was present the owner opened the abscesses on the nose and proceeded to castrate the pigs with the same knife. Out of 48 pigs castrated, 42 developed scirrhous cords on one or both sides. In another herd where the same procedure was followed approximately 75% of the castrated pigs developed scirrhous cords.

Since scirrhous cords are caused by a spirillum, and the two diseases are closely allied, it is perhaps reasonable to assume for purposes of control that rhinitis is a similar infection.

I do not believe that the form of rhinitis which produces distortions of the facial bones, commonly called bull nose, in the central west is the same disease described by German veterinarians as rhinitis and caused by *B. pyocyaneous.* The symptoms and courses of the two diseases are quite different. One being primarily an acute infection, the other is usually a chronic process.

Symptoms.—The course of rhinitis in pigs is ordinarily slow, insidious, and chronic. Often, nothing out of the ordinary is observed by the herdsman until a marked distortion of the nasal bones or a nasal abscess is noticed.

In the beginning the animals have a slight fever and more or less nasal inflammation with a limited muco-purulent discharge from the nostrils, which may contain blood. Sometimes affected pigs sneeze, and shake their heads as though trying to dislodge a foreign object from the nasal cavities. The breathing may be labored and accompanied by a snuffling sound. A close examination will reveal inflamed and thickened nasal and ethmoid mucosa. After

a few weeks there is an increase in the size of the nose with bulging of the facial bones. In due time the abscesses, which form, break open and discharge the pus with a characteristically fetid odor through the nasal bones some place between the eye and the snout. The disease process may extend to the frontal and maxillary sinuses. The turbinated bones are often necrotic. Pseudomembranes form due to invasion by *Actinomyces necrophorus*. The pigs eat with difficulty and emaciation is marked. Death may ensue as the result of inanition and toxemia. If the pig lives, a fistulous opening through the nasal bones will continue to discharge for several weeks, but will finally heal, leaving a marked distorted and enlarged nose (bull nose).

Treatment. — No treatment has been found that is universally successful. Our principal efforts should be directed towards prevention. Sanitation and proper feed are important. The elimination of mud-holes is absolutely necessary. Moving the well pigs to clean ground will help check the spread of the infection. Local treatment is of questionable value. Even if recovery takes place, ordinarily, a bull nose pig is an economic liability. For this reason destruction of advanced cases is often advisable.

Removal of Mammary Tumor

Ligation is the easiest and most satisfactory way of removing a mammary tumor.[37] The animal being tied up by the snout, the operation is done standing, or with the side lines, when the animal is cast. The ligature should be tied on a single knot at each half turn round the neck of the tumor, passing round three or four times, until it is finally secured. If tied sufficiently tight, the mass falls off in five or six days. A strong solution of creolin should be poured over the ligature, and afterward applied daily to the wound. The ligature does not appear to cause pain, but it is advisable to inject a 5% solution of cocaine in three or four places along the neck of the tumor.

[37] Hudson, R. 1934. Tumors of the mammary gland and their removal. *Vet. Jour.* 90:138.

Value of Agglutination Test in Erysipelas

Eight pigs were exposed to swine-erysipelas[45] infection by injections of cultures of *Erysipelothrix rhusiopathiae*. Six of the pigs which showed clinical symptoms of swine erysipelas developed agglutinins in the blood detectable from the third to the sixth day after inoculation, thus indicating that the agglutinins make their appearance early in the disease, or within a brief period after the first clinical evidence of the disease is noted. The other two pigs, three weeks of age, failed to show any clinical evidence of infection, and the blood of these pigs remained consistently negative to all plate and tube tests for swine erysipelas, made on various dates subsequent to the time of exposures.

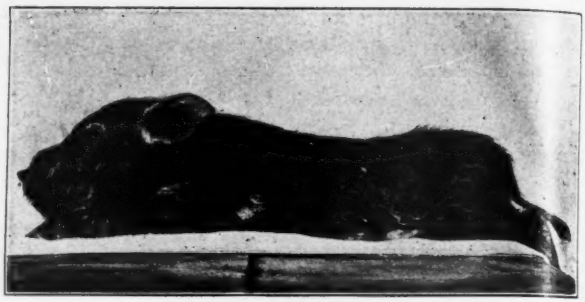
Blood serum from a pig which showed typical diamond skin-lesions, or the urticarial form of swine erysipelas, and from which *Erysipelothrix rhusiopathiae* was recovered, gave negative results to both the plate and tube agglutination tests for swine erysipelas. Negative serological results have been reported in five other cases of typical diamond skin-disease. The reason for the failure to agglutinate has not been determined.

It has been demonstrated experimentally that the subcutaneous injection of 30cc of anti-swine-erysipelas serum (equine) resulted in the passive transfer of agglutinins, which could be demonstrated readily within 24 hours by the plate and tube tests. The titer of the serum of the experimental pig, which was entirely negative prior to injection, indicates that a very large portion of the agglutinins in the injected serum had been transferred to the normal pig. This offers an explanation for the remarkably rapid improvement following the injection of anti-erysipelas serum in the disease. Another pig of approximately the same age and weight, injected subcutaneously with 30cc of normal horse serum remained consistently negative to both tests.

[45] Schoening, H. W. and Creech, G. T. 1935. Serological studies of swine erysipelas with particular reference to agglutination. *Jour. Agric. Research.* 50:71-79.

Stomatitis of Pigs

By C. C. HASTINGS,
Williamsville, Illinois



Necrotic Stomatitis

STOMATITIS of pigs is an acute infectious disease of suckling pigs characterized by an inflammation of the buccal mucosa and of the skin adjacent to the mouth.

It occurs in all seasons and more or less continuously in the areas where there are large numbers of swine. It leads to serious economic losses, particularly on farms where it appears year after year with losses ranging from 10 to 30% of the pig crop. This disease is no doubt responsible for more baby pig losses than are usually charged against it by herd owners. Due to the relative unconcern of many swine raisers towards baby pig losses it has not received the attention it merits.

Insanitary conditions and muddy pens appear to be particularly favorable to the spread of the infection, and also augment its virulence. Undernourishment, large litters, and too close confinement, causing the pigs to fight for the teats, favor its dissemination in the herd. The infective agent is evidently contained in the saliva.

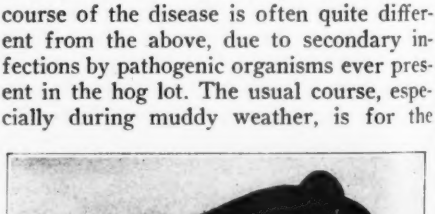
Etiology.—While we must recognize local irritants, caustic chemicals, irritating plants, fungi, and nutritional disturbances as occasional causes of stomatitis in pigs, by far the greatest number of outbreaks seen in practice bear all the characteristics of a communicable disease and should be treated as such. The latter is the only form we will discuss here.

The etiological organism has not been determined. Several organisms have been isolated from the lesions by different investigators, but none of them have been proved to be the primary invader. In all probability they were secondary infections.

It has been my opinion for a number of years that stomatitis is a type of pig pox that affects the suckling pig, and that one attack confers permanent immunity. In a district where pig pox is very prevalent the disease has not been observed in shote herds that suffered from stomatitis as baby pigs.

Symptoms.—The first symptom observed is evidence of pain when sucking, i.e., shaking the head with saliva dripping from the mouth. If the mouth is examined the buccal membrane is found swollen and reddened. A day later, small vesicles of the size of a clover seed appear near the margins of the gums. These gradually increase in size until the entire cavity, lips, and snout are involved. The pigs are listless, lie in the bed and nurse but little if at all. The temperature ranges about 104° F.; respirations are increased. The vesicles rupture in approximately three days, discharge their contents and, if no secondary infections gain entrance, heal completely in about six days.

Under farm conditions, however, the course of the disease is often quite different from the above, due to secondary infections by pathogenic organisms ever present in the hog lot. The usual course, especially during muddy weather, is for the



denuded surfaces to become covered with mud and filth. Pseudomembranes form. The mouth is swollen until nursing is impossible. There is suppuration and the formation of extensive necrotic areas covering the buccal mucosa, lips and snout. The diseased area keeps enlarging, becomes confluent until the entire mouth cavity and the adjacent skin are one large sore covered with a diphtheritic membrane. The disease process may extend to the pharynx and trachea with pneumonia as a complication. The pig succumbs from starvation, or toxemia due to absorption of toxins from the diseased surface. The secondary infections are usually *B. necrophorus* or a paratyphoid organism.

In case of favorable termination the local changes are not so marked, the necrotic process is entirely absent or does not penetrate so deeply.

Treatment.—In the uncomplicated form treatment is of little value. If proper hygienic conditions are provided the termination will be favorable. Secondary infections should be treated symptomatically. The false membranes should be removed and the raw oozing surface treated with equal parts of glycerine and tincture of iodine.

Every effort should be made to prevent contamination of the wounds with barnyard filth. The sows and pigs should be moved to clean pasture and all possible sanitary measures observed. If this is done at the very beginning of the outbreak the death loss will be materially lessened.

Rather close observation over a period of years has caused me to reach the opinion that all cases of stomatitis are practically identical in the beginning. The different forms seen in practice being but different manifestations of the same disease, probably depending upon the kind of secondary infections that gain access to the denuded areas. The suppurative and necrotic conditions are secondary and have nothing to do with the primary cause. Uncomplicated stomatitis of pigs is a benign disease. During dry weather, when sows and pigs are on fresh pasture, many outbreaks pass unnoticed by the herdsman.

Pityriasis Rosea

Several years ago, in the spring, the writer had occasion to examine two young pigs belonging to a farmer in Cass County, North Dakota. The owner was seeking information because of a rather strange skin disease he had noticed among a few of the pigs in different litters.

The history disclosed that the condition had developed unobserved. The pigs had attracted attention by their indisposition and a diarrhea. On closer investigation the farmer noticed, on the skin of the abdomen, a peculiar swelling, about which he was seeking advice.

The clinical examination revealed a raised fold of inflamed skin, roughly circular in shape. It included the navel and extended to the underchest. The ridge was about ½-inch high and about ¾-inch thick at the base. It enclosed an area of normal skin of approximately the size that could be covered by the outstretched hand of a man. The circular fold appeared distinctly inflamed, and bluish-red in color. The skin forming the swelling was firm and not particularly sensitive to the touch; its surface appeared granular, and was covered with scales along certain sections.

No microscopical or histological examination was made at that time. The owner was advised to apply disinfectants. A later inquiry as to the result of the treatment elicited the statement that the pigs made an uneventful recovery.

The appearance of the skin lesions in these two pigs, as seen by the writer, seemed to be identical with the lesions in pigs, seen, described and illustrated by Schindelka in his textbook on skin diseases of domestic animals (volume 6 in Bayer-Fröhner's "Handbuch der Tierärztlichen Chirurgie"), and tentatively diagnosed by him as "pityriasis rosea."

The writer is not aware of any mention of this interesting ailment from pigs in the United States. The apparent extreme rarity of this skin disease has prompted the present case report.

Chicago, Ill. F. VOLKMAR.

Pulmonary Edema

By A. T. KINSLEY,
Kansas City, Missouri

PULMONARY edema is a name that has been applied to a condition that is characterized by an accumulation of fluid in the intercellular tissue spaces of the lung. This condition has occurred more or less frequently in the central states for the past several years. Usually only a small percentage of a herd is affected. It is apparently most common in swine weighing 100 pounds or more. Breed, feed, and general management appear to have no influence on the occurrence of this malady. There may be some relationship between pulmonary edema in swine and flu.

Cause

Pulmonary edema is a distinct pathologic condition and results from an increased permeability of the pulmonary capillaries. Whether or not the damage of the capillaries is due to a specific infection has not been determined. However, a diphtheroid microbe has been isolated in many instances from the lesions of pulmonary edema. It is probable that this malady is a toxemia and that the toxic substance, bacterial or otherwise, is responsible for the edema and the manifested symptoms.

Symptoms

Pulmonary edema is manifested by dullness, depression, accellerated breathing, thumping, temperature rarely above 104° F, impaired appetitie, and, in some instances, a dry cough. There will also be dyspnea in varying degrees, depending upon the extent of the edema. In mild and chronic cases, cough and limited thumps may be the only symptoms noted. There is rapid shrinkage in the affected animals.

Lesions

The characteristic lesion is a collection of fluid in the lung. An affected lung, when observed in the initial stages, has a peculiar grayish color, does not collapse, and has a doughy or rubbery consistency. In fatal cases practically the entire lung is involved. The lung lobules will be well outlined by the edematous fluid that has accumulated in the interlobular spaces. In those cases that survive for several days, the edematous fluid will gravitate into the dependent portion of the lung. Thus, the dorsal part of the lung is apparently normal and the dependent portion solidified.

In subacute cases the edematous lesion may become necrotic or abscess formation may occur.

Diagnosis

The symptoms of pulmonary edema should give a clue to the identity of the disease. But, in any event, the lesion, which is edema of the lung, is sufficient evidence upon which to base a diagnosis.

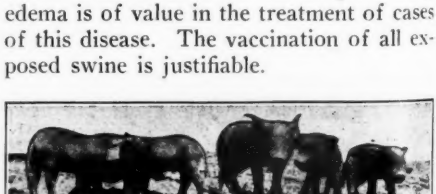
Pulmonary edema may be confounded with pulmonary hemorrhagic septicemia. This latter malady is characterized by an atypical catarrhal pneumonia. Thus, the lung lesion in the two diseases is quite different.

Flu can usually be differentiated from pulmonary edema by the fact that in flu a large number of swine become affected at once, and also by the characteristic cough and high temperature.

Control and Treatment

The observance of good sanitation is of value in the prevention of this malady. Although it has not been proved that pulmonary edema is a specific infectious disease, good judgment favors isolation of diseased animals as well as thorough cleaning and disinfection of contaminated, hog houses.

According to the experience of numerous practitioners the use of a properly prepared bacterin made from diphtheroid cultures obtained from lesions of pulmonary edema is of value in the treatment of cases of this disease. The vaccination of all exposed swine is justifiable.



Swine-pox (Variola Suilla)

By A. T. KINSLEY,
Kansas City, Missouri

SWINE-POX is a specific infective eruptive disease of swine; first identified by Spinola in 1842. How long the disease has been prevalent in this country is unknown. Some eight or nine years ago the malady was relatively common in some sections of Missouri and Iowa. In 1929, McNutt of Ames, Iowa, reported finding swine-pox in about 1% of all the hog cases sent in for diagnosis.

Swine of all sizes are susceptible to swine-pox but according to many investigations, pigs up to 2½ months of age are most susceptible. The disease is said to be more virulent in warm than in temporate climates. A relatively virulent outbreak occurred in 1931 in Missouri, and probably in some adjoining states. It usually affects 50 to 80% of all swine in a herd.

Cause

Swine-pox is caused by a filterable virus. Like other variolas the virulence of the virus of swine-pox varies. The possibility of the transmission of variola virus from one species of animals to another is still a moot question. Thus far, the occurrence of pox in cattle that have been in contact with swine affected with pox has not been observed; neither has there been any authentic cases of the transmission of cow-pox to swine.

Symptoms and Lesions

In the mild type of swine-pox there is practically no systemic disturbance. The more severe form is manifested by dullness, impaired appetite and a temperature up to 107° F. Within two to four days after the appearance of the initial symptoms, cutaneous eruptions develop, usually on the venter surface of the abdomen. Occasional cases are observed in which eruptions may also occur on the ears and well up on the sides. These eruptions form a sequence of papules, vesicles and scabs. The pustular lesion of cow-pox does not occur in swine-pox. Swine-pox lesions are not as definitely umbilicated as are the lesions in cow-pox. In fact, the successive changes of the cutaneous eruptions of swine-pox are usually less distinct than in most other variolas. Individual pox lesions are about 0.2 inches in diameter. Two or more pox lesions may become confluent. The disease runs its course in from three to five weeks, the scab desquamates and leaves no scar.

Diagnosis

The diagnosis of swine-pox is dependent upon the identification of the cutaneous eruption. Even though the successive changes in the skin lesion of swine-pox are not as clear cut as they are in other variolas, they are usually sufficiently distinctive for a diagnosis. The simultaneous occurrence of swine-pox and erysipelas may result in a symptom complex that is misleading. Acute erysipelas may be accompanied by diffuse scarlet red discoloration of the skin of the abdomen. The papule of the swine-pox lesion is red but it is circumscribed. The temperature is usually higher and depression and dullness are more marked in erysipelas than in swine-pox.

Control

Treatment of swine affected with pox is futile. It might be possible to collect vesicular fluid and scabs from pox lesions, in mild cases, and vaccinate the exposed unaffected animals. Should swine-pox become more common it is probable that a protective vaccine will be prepared.

Swine-pox is particularly significant in the vaccination of hogs with serum and virus for excessive post-vaccination losses are prone to occur in swine that are in the incubation stage or are showing early symptoms of swine-pox when inoculated with serum and virus.

Is there any wonder that swine of today are subject to a variety of diseases, when the modern hog, which in comparison to its ancestor, has a diminished capacity of the lungs and of the digestive tube, is maintained in filth, and is force-fed to make it marketable at six or seven months of age.

Swine Flu

By A. T. KINSLEY,
Kansas City, Missouri

Flu is a specific disease of swine, first recognized, identified and named by Koen in 1918.

This malady prevails in practically every section of the country and may occur at any season, although it is probably most prevalent during the fall and spring. Flu is essentially a herd disease as from 75% to 90% of the herd usually becomes affected within a few hours. Swine of all breeds and any age are susceptible to flu.

Dr. J. S. Koen, the first to diagnose and name swine influenza. Of course, the announcement was made in Veterinary Medicine first.

Cause

Shope of the Department of Animal Pathology of the Rockefeller Institute demonstrated the possibility of transmitting flu by a filtrate from suspensions of tracheal and bronchial exudate from infected swine. The disease induced by the filtrate varied with different strains of virus. In addition to the filterable virus a micro-organism similar to *Haemophilus influenzae* was found constantly in field cases of swine flu.

This bacterium has not been found either in healthy swine or in swine in which the disease has been produced by the filtrate.

Recently isolated cultures of the *Haemophilus influenzae*-like micro-organism when introduced intranasally produced a condition that was quite similar to the natural disease but differed from the natural disease in that it was not contagious. Old cultures of the *H. Influenzae*-like bacillus were not pathogenic. However, when small quantities of the non-pathogenic cultures were injected simultaneously with filtrate, typical cases of swine flu developed.

Thus, experimentally, Shope has apparently demonstrated that the primary cause of swine flu is a filterable virus. The constant finding of the *H. Influenzae*-like bacillus and the apparent increased pathogenicity of the combination of filterable virus and this bacillus experimentally must not be overlooked. It appears that the filterable virus and the bacillus may act synergistically.

Symptoms

The intensity or virulence of flu varies. It is usually most virulent during changeable and cold weather. The acute virulent type is characterized by a rapid onset and spreads through a herd in a few hours. The usual symptoms of the sthenic type are: A temperature ranging from 106° to 108° F., spasmodic pharyngeal or bronchial cough, thumps, inappetence, marked rapid shrinkage, and a tendency for the affected animals to lie in their beds. Driving them from their beds excites the coughing.

The mild type of flu is characterized by the same symptoms that characterize the acute form of the disease, but the symptoms are less intense.

The course of flu is relatively short; the symptoms usually vanishing in a few days, the mortality is quite low. Flu is of considerable economic importance because of the marked shrinkage of affected swine. It is also of importance to the breeder because of the extensive loss of pigs from sows that have had an attack of flu while pregnant. In some cases there is abortion of the fetuses and in others the pigs are carried full time but have little vitality and die soon after they are farrowed.

Lesions

The lesions in flu are entirely out of proportion to the extent or magnitude of the symptoms. The usual lesions of uncomplicated flu are: mild rhinitis, bronchitis and pulmonary edema. In several cases the trachea and larynx also may be inflamed.

Differential Diagnosis

Pulmonary strongylosis is an afebrile disease of a slow onset, characterized by paroxyms of bronchial coughing. The finding of numerous strongyles in the lungs at autopsy will suffice to make a diagnosis of pulmonary strongylosis.

Should a herd infested with pulmonary strongylosis, become affected with flu of the severe type, the symptoms manifested would be a high temperature, inappetence, thumps, and coughing. A post-mortem examination reveals the pulmonary edema and the strongyles justifying the diagnosis of pulmonary strongylosis complicated with flu.

The usual complication of flu is pulmonary hemorrhagic septicemia, and the outstanding lesion of the latter malady is an atypical catarrhal pneumonia with or without pleuritic adhesions. When flu of the acute type is complicated with pulmonary hemorrhagic septicemia the mortality may be high.

Control and Treatment

According to Shope, swine can be immunized against flu by the intramuscular or subcutaneous injection of virus obtained from the lungs of infected ferrets or mice. However, swine flu followed the intramuscular administration of virus in some field experiments and therefore it is not wise to attempt the immunization of swine against flu in routine practice. Other than this, there is no specific serum, vaccine or drug that has any value in the control or treatment of flu. Affected swine should be given the best of care, including good housing, particularly dry but not dusty bedding and protection from inclement weather.

Many practitioners believe that it is good practice to vaccinate all herds affected with flu and unaffected herds on adjacent farms with a bacterin, containing bipolar and diphtheroid organisms, thus protecting the exposed animals against hemorrhagic septicemia and pulmonary edema.

Hemorrhagic Septicemia (Swine Plague)

By A. T. KINSLEY,
Kansas City, Missouri

THIS malady usually occurs sporadically or enzootically. It rarely assumes an epizootic form. The disease is widespread and the prevalence is variable. It has been more prevalent than usually during the late summer and early fall months of 1936, at least in some sections. Thus, in Eastern Iowa, a fatal pneumonia (pulmonary hemorrhagic septicemia) has been reported frequently. Porcine hemorrhagic septicemia is most common in shotes weighing 50 to 125 pounds, however, suckling pigs are frequently affected and aged brood sows have died of this malady. Apparently, all breeds of swine are equally susceptible. The percentage of mortality of this malady varies from zero to 75%.

Cause

Hemorrhagic septicemia is caused by *Pasteurella suiseptica,* a short bipolar-staining, polymorphic, non-motile, non-spore forming organism that grows readily on practically all culture media aerobicly and anaerobicly. It is easily destroyed by disinfectants. Small experimental animals are susceptible to the pathogenic action of these organisms and by the use of certain strains it is possible to infect practically any of the larger animals with fatal outcome. It is generally conceded that infection with *P. suiseptica* occurs most frequently when the resistance of the exposed animals has been reduced. Thus, hemorrhagic septicemia is prone to occur in swine that are affected with hog cholera or necrotic enteritis and in those that are harboring parasites. Swine that have been subjected to the hardships of shipping, pigs that have been weaned recently, and swine which have been improperly fed and housed are more susceptible than swine not debilitated by these or similar causes. It is probable that the Eastern pneumonia that was so prevalent in 1936 was due to the excess dust in pens and sleeping quarters incident to the severe drouth of last summer.

Symptoms

The period of incubation, at least in artificially infected cases, is of short duration, rarely exceeding two days. The septicemic type of the disease has a sudden onset and is characterized by a diminished appetite, weakness, and a temperature of 105° F. to 106° F. There may be a blush or congestion of the skin, particularly on the venter surface of the abdomen. This form of the disease is rapidly fatal; the duration rarely exceeding 12 hours.

The pulmonary form of the disease is the most common and is the type usually designated "swine plague." Pulmonary hemorrhagic septicemia is evidenced by a short dry spasmodic cough, dyspnea, temperature up to 105° F., mucous or muco-purulent nasel discharge, impaired appetite, usually constipation, and a tendency for the affected animals to sit on their haunches. As the disease progresses, breathing becomes more difficult and extreme weakness and marked emaciation supervene.

The usual course of the acute pulmonary type is about one week and the mortality is relatively high. In the prolonged subacute or chronic cases of pulmonary hemorrhagic septicemia, there is a persistent cough, emaciation and weakness; such cases may terminate fatally in four to six weeks. A varying percentage of swine affected with the pulmonary form of hemorrhagic septicemia ultimately recovers, but the lost flesh and vigor is so slowly regained that these pigs are usually a liability rather than an asset to the breeder.

There may be intestinal and cerebral forms of hemorrhagic septicemia in swine, but these forms, and particularly the intestinal type, if there is such, are so admixed with other infections that they are difficult to identify as separate entities.

Lesions

The septicemia type of swine plague is manifested by petechial hemorrhages in the serous and mucous membranes, and possibly also in the skin. The lymph nodes are usually tumefied and hemorrhagic. There may be hemorrhages in the kidneys and in other organs.

Hemorrhagic Septicemia

The pulmonary type of the disease is characterized by an atypical catarrhal pneumonia. Different areas of the lung show different stages of the disease, such as congestion, red hepatization, grey hepatization and resolution or necrosis. The different stages of progress of the disease result in a mottled or marbled appearance of the lung. In hemorrhagic septicemic pneumonia, the interlobular spaces are clearly outlined because of the excessive serous infiltration. The bronchial and mediastinal lymph nodes are usually tumefied and hemorrhagic and in the chronic cases the nodes may contain necrotic areas. The pleura, at least that part lying adjacent to the involved area in the lung, is usually affected with a fibrinous inflammation; adhesions of the visceral and parietal pleura are likewise common.

Diagnosis

The septicemic type of porcine hemorrhagic septicemia is difficult to differentiate from hog cholera. A careful consideration of the history of the outbreak, symptoms and lesions will usually give the basis for a correct diagnosis, although in some instances the demonstration of the *P. suiseptica* of hemorrhagic septicemia or the filterable virus of cholera is the only certain method of making a positive diagnosis.

The pulmonary type or swine plague, is not difficult to diagnose if the post-mortem findings are properly interpreted.

Prevention and Treatment

Prevention by enforcement of sanitary regulations is of considerable value in the control of this disease. The spread of the pulmonary form of the disease is apparently favored by dry weather probably due to the irritating effects of dust.

This disease has been successfully controlled on farms by the administration of properly prepared bacterins. Aggressin has been used in apparently healthy stocker pigs at public markets but the results have not been uniform.

Pig Influenza

Pig influenza causes more economic damage in Germany[47], than is experienced from hog cholera or from swine erysipelas. Pigs up to the age of six weeks are most prone to succumb to this disease. With increasing age a certain resistance develops, but this resistance does not confer complete protection. The etiological factor is a pneumotropic virus, closely related to that of swine flu. Whether the pig influenza is merely an attenuated form of swine flu remains to be proved. Carriers do not play a rôle in this disease, due to the low resistency of the virus. Epidemics of pig influenza spread from herd to herd by the addition of breeding stock and of weaned pigs. The various sera tested did not have any curative or preventive action. Hygienic measures, including isolation of the litters, suffice to combat the disease.

[47] Waldmann. 1936. Epidemiologie und Bekämpfung der Ferkelgrippe. *Deutsch Tierärztl. Wchnschr.* 44:847-850.

Sterility in Swine

By A. T. KINSLEY,
Kansas City, Missouri

Low breeding efficiency is one of the most important economic problems that confronts the swine producer and the veterinarian. The feed shortage incident to the extensive drouth in recent years has resulted in the depletion of breeding stock to such an extent that when crop production becomes normal the number of efficient breeding sows and boars will be found inadequate.

Prevalence

The loss of pigs up to one month of age on American farms is appalling. The loss due to sterility in boars and sows is much larger than is usually suspected. Efforts have been made to obtain definite information relative to the prevalence of sterility in swine but the data collected thus far is not sufficient upon which to base a general statement. Sterility is about equally prevalent in all breeds. On some farms sterility is apparently most prevalent in sows after the first farrowing. The reason for this has not been determined.

The percentage of sterility in sows is quite variable. On some farms it has been found that at least 50% of the breeding sows are sterile. On other farms, practically all the sows are sure breeders. However, it is the exception to find a herd of 15 or more sows that consists of 100% breeders.

Sterility in sows is prevalent in all sections of the country. It is probable that a larger percentage of sterility occurs in areas of intensive swine production than where fewer hogs are bred.

Sterility in boars is far more common than is usually believed. Some practitioners contend that sterility is more prevalent in young than in mature boars.

Cause

Sterility may be temporary or permanent. Occasionally malformation of the genital organs in the sow or boar are the cause of permanent sterility.

Long continued inbreeding, insufficient exercise, overfeeding, and particularly the feeding of a fattening ration, all may be factors in the production of either temporary or permanent sterility.

The most important factor in the occurrence of sterility in sows is the influence of a previous disease, particularly of disease in which abortion and metritis occur. Swine flu, hog cholera and other infections associated with a high temperature are frequent causes of abortion and may be the forerunner of sterility. Pathological involvement of the ovaries and especially cystic ovaries are common in sterile sows.

Sterility in boars is frequently the result of injuries to the genital organs. Mechanical injuries may be followed by infections and cause non-breeding. Excessive use and abuse are important predisposing factors in the production of "slow breeders" and sterility. Small litters and the production of pigs of low vitality can frequently be traced to excessive breeding service, as in "pasture breeding."

Improper feeding and the use of immature boars are important factors in sterility of boars. Thus, according to Phillips and Andrews of the Massachusetts experiment station, a low plane of nutrition retards the development of the testes. They also report that spermatazoa first appear in normally developed boars, at approximately the fifth month of age; therefore, boars should not be used until they are seven or eight months of age.

The porcine type of the *Brucella abortus* may invade the testicles and result in the destruction of testicular tissue and render the boar sterile.

Symptoms

Sterility in sows may be evidenced by persistence of the estral period which may be regular or irregular. Purulent discharge from the genital organs is relatively common and indicates vaginitis or metritis.

Sterility in boars may be manifested by "slow breeding." The testicles may be swollen and sensitive. There may be a disturbance of locomotion. Affected boars are frequently unthrifty.

Prevention

The percentage of sterility in breeding swine can be reduced to a minimum by observing the basic principles of feeding, care and management, sanitation and sex hygiene.

Breeding swine and particularly gilts and young boars should be fed a maintenance, growing ration, not a fattening ration. The restriction of the diet to corn and water favors the occurrence of sterility. Ground barley or oats and semi-solid buttermilk form a fairly good diet for breeding sows and boars that are in service.

Breeding sows and boars should be kept in clean quarters of sufficient size to provide for ample exercise. Pens and shelter houses should be kept as clean and sanitary as possible.

Diseased sows or boars should be segregated and not bred until they have recovered. The breeding of sows, having a purulent discharge from the vulva, favors the spread of infection to the boar and thence to other sows. Excessive use of a boar may cause orchitis which will diminish or destroy the vitality of the sperm cells. Boars should not be permitted to run with the sows during the breeding season as this favors excessive service. All breeding should be done in a small pen, and after the service the sow should be removed. A young boar should be restricted to one service every other day and a mature boar to one service daily.

Treatment

The breeder is desirous to know whether sterile sows or boars can be treated successfully and at a cost that will be justifiable. An intelligent answer to these questions involves a consideration of several factors. Only good individuals should be treated. All others should be placed in the fattening pen. All sows that are to be treated should be segregated in sanitary quarters and provided with a proper ration. Metritis cases may respond to the use of a properly prepared autogenous bacterin. Sterility, resulting from diseased ovaries, may be overcome, in large sows, by ovary manipulation. Cystic ovaries in sows may also be treated by making an opening through the abdominal wall similar to the incision made for the flank method in cesarean section. This method of treatment is radical, and is not advised for general use.

When sterility is a sequel to Brucella infection it is less difficult to control in sows than in cows. In porcine abortion disease there is apparently a tendency to localization of the infection and the disease is rather self-limiting. Many practitioners believed that by the use of an abortion bacterin (not now on the market) the percentage of sterility was reduced to a minimum. It is probable that the abortion vaccine will produce favorable results in swine practice.

Sterility in swine is an important problem and one in which the practitioner can render the swine industry a valuable service. In some cases it is more economical to treat aborting sows and sterile sows, that are good individuals and have previously been good breeders, than to depend upon gilts each year for pig production. In other cases the gilts are favored.

Visceral Adhesions

The inspection of the viscera of 500 hogs disclosed in 15 viscera a coalescence between the spleen and the pancreas.[39] The coalescence was formed by a 10cm-long bridge of spleen tissue connecting with the cone-shaped end of the tuberculum caudatum of the pancreas.

Coccidiosis in Pigs

Coccidiosis infection occurred in pigs less than six weeks old.[38] It appeared to be contracted from sucking teats contaminated with feces. The infection rate in pigs depends upon the severity of the maternal infection. Infected pigs are weak and unthrifty, but do not display symptoms of severe disease. The infection rate increases with age. In some farms it rose to 85% in swine over one year of age.

[39] Kadletz, M. 1936. Verwachsungen zwischen Milz und Pankreas beim Schwein. *Deutsche Tierärztl. Wchnschr.* 44:595-598.

[38] Yakimoff et al. 1936. Zur Schweinekokzidiose in Russland. *Berl. Tierärztl Wchnschr.* 52:358-362.

Post-Vaccination Losses in Swine

By A. T. KINSLEY,
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IT IS common knowledge that swine may die after they have been vaccinated. The loss of an occasional hog in herds that have been vaccinated is expected and provokes little or no comment. Such cases are not included in the so-called post-vaccination losses. Formerly, it was quite generally assumed that the losses of swine after vaccination were attributable to some fault of the serum or virus that had been used; hence, the terms "serum break" and "virus break." It is conceded that serum breaks and virus breaks have occurred and may occur in the future but it is now recognized that the majority of post-vaccination losses in swine are not due to faulty serum or virus. Furthermore post-vaccination losses may be due to diseases other than cholera.

The following basic facts are pertinent in swine immunization: (1) Swine are subject to numerous fatal maladies. (2) Serum and virus are efficient biological products but produce an immunity to cholera only.

So far as known, swine that have been immunized, either by simultaneous vaccination or by having cholera and recovering, are not carriers and spreaders of virus. However, virus persists in a hog that is being immunized for about twenty days. During this period and more particularly during the virus reaction period, there is a leucopenia, which probably increases the susceptibility of swine to diseases other than cholera.

Vaccination virus may produce lesions that persist for probably a month and those lesions may be quite typical of cholera. It should not be forgotten that vaccination immunity is an acquired immunity and is therefore not absolute, and may be temporarily diminished or suspended.

Swine can be successfully immunized against cholera, provided:

1. The swine are healthy when vaccinated.
2. The swine are of proper age when vaccinated.
3. The serum is potent and the virus virulent and given in proper dosage.
4. The vaccination is properly performed.
5. The swine are properly cared for after vaccination.

If each of the five foregoing provisions are fulfilled, the vaccinated hog will have an acquired immunity, that under ordinary and usual conditions, will persist for from one to several years.

Causes of Post-vaccination Losses

Serum breaks are due to the use of a low potency or insufficient serum. Serum breaks, in recent years, have been rare. The production and sale of a low potency serum is possible but not probable. Under-dosing of serum due to underestimating the weight of the hog occur. Under-dosing to meet competitive prices is past history. Serum breaks usually occur in from 7 to 15 days after vaccination.

Vaccination virus gradually becomes attenuated and will ultimately become avirulent. It is possible that the duration of virulency may vary in different lots of virus. If virus is not properly shipped and properly stored it may become avirulent before the indicated expiration date.

Virus is refrigerated by the producer from the time of its production until it is delivered to the practitioner and should be refrigerated by him until it is injected into the hog. A practitioner that does not provide means of refrigeration for the virus he uses, both at his office and in his car, is certainly inviting trouble. The use of an attenuated or an avirulent virus does not produce an active immunity. Virus breaks occur but they are not common if virus that has been properly refrigerated is used. Losses from cholera occurring four weeks after vaccination or later may or may not be due to a virus break. Parasitism, bacterial infections, and improper feed and care may overcome the induced cholera immunity. In such cases, cholera may not

be the primary cause of death. In fact, it may be only a minor factor even though virus may be present in the blood. Losses, suspected of being virus breaks have been found to be due to erysipelas, others have proved to be *S. suipestifer* infection and still others parasitism.

Losses other than those due to serum and virus breaks, constitute the major portion of post-vaccination losses. The most common causes of these losses are parasitism and bacterial infections. Thus, *S. suipestifer* infected swine may appear perfectly healthy and normal at the time of vaccination and yet they may have a rather extensive subacute or chronic enteritis, or they may be in the incubation stage of any of the acute infective diseases, including cholera. Pathogens, parasitic and bacterial, become more active and aggressive during the virus reaction period and affected swine that are vaccinated are prone to become visibly sick in four to eight days. Death loss is probable in such cases.

Post-vaccination losses in swine, immunized as baby pigs, may occur four to six weeks after vaccination, or later, since baby pigs are not always solidly immunized.

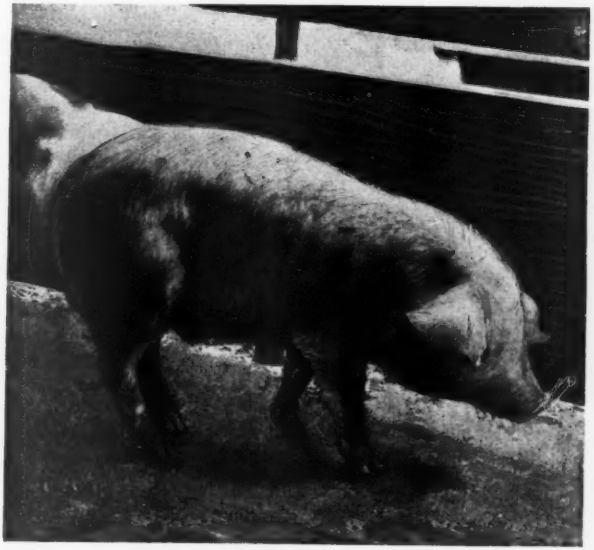
If serum, and more particularly virus, is injected into fat tissue, absorption may be retarded and insufficient serum may be absorbed, resulting in a serum break or insufficient absorption of virus may result in a virus break. The use of syringes and needles contaminated with the organisms of malignant edema, anthrax, etc., will probably result in post-vaccination losses. Similar losses may occur if serum and virus containers are not properly protected against dust.

Improper feed and care of vaccinated swine may result in post-vaccination losses. Extensive losses may occur in pigs that are weaned at the time of vaccination. The heavy feeding of concentrates immediately after vaccination is prone to result in losses. Placing hogs in corn fields immediately after vaccination is a dangerous practice. Permitting hogs access to stagnant ponds and mud holes immediately after vaccination may result in losses due to malignant edema and related infections.

Diagnosis

The loss of one or two swine within a few days after vaccination is not at all unusual and should cause no concern unless several others in the herd are visibly sick. If several have died and more are sick, a careful investigation should be made, including history, symptoms, lesions and in some cases, laboratory tests.

A detailed history should be obtained from the owner or caretaker. Ascertain definitely whether or not there had been any sickness or deaths prior to vaccination. How long after vaccination was sickness first observed, etc. A reliable history if obtained will usually reveal many important facts. Do not lose sight of the fact that the vaccinated hog is more variable than any of the other factors in the chain of immunization. The cause of most post-



Acute Hog Cholera (Advanced Stage)

vaccination losses is resident within the vaccinated hog. In obtaining the history be certain to obtain a detailed account of the care and feeding of the swine following vaccination. The investigator should ascertain the brand, the amount and the serial number of the serum and virus that were used. This is usually a matter of record.

After all possible information relative to history has been obtained a careful study of the symptoms should be made. It is possible that the symptoms may not be characteristic of any one specific malady, for post-vaccination losses are prone to be a complication of diseases rather than a specific entity.

Careful post-mortem examination should be made of the carcasses of hogs dead only a short time, or of hogs destroyed for necropsy. In checking up the lesions observed, do not overlook the fact that vaccination virus may produce lesions typical of cholera. Note whether or not such lesions are of recent origin or are of long standing.

In many instances a careful analysis of the history, symptoms and lesions will give sufficient information upon which to base a diagnosis. In other instances it will be necessary to submit specimens or an affected pig to a reliable laboratory for further study.

How to Prevent Post-vaccination Losses

It is more satisfactory to the practitioner to avoid post-vaccination losses than to stop them. It is also more profitable for the swine owner. These losses can be diminished by:

A careful examination of the swine to be vaccinated. Not infrequently a herd of swine may be in the incubation stage of cholera, flu, erysipelas and other infections and parasitisms. In some cases the temperature will give warning. When swine that are put up for vaccination are found to be affected with any other disease than cholera, they should be treated for that disease before being immunized against cholera. The vaccination of baby pigs, according to the experience of numerous practitioners, is not good practice.

The use of a full dose or an overdose of a reliable and properly handled serum and virus, will diminish losses.

Be certain that all vaccination equipment is in good condition and has been sterilized.

Give the caretaker specific instructions relative to after-care and feeding. Post-vaccination losses are reduced by following the foregoing suggestions and particularly if only healthy hogs are vaccinated, and a potent virus is used.

Round Table Discussion of Swine Practice Problems*

What is sun scald in hogs?

An anaphylaxis due to a foreign protein and characterized by an erythema, scaling of the epidermis and the formation of cracks or rhagades in the skin. The back is the most frequently involved. It is apparently most common when there have been heavy dews or rains followed by sunshine, and when the hogs are running in pastures in which grass and weeds are as high as their backs. The sunshine and moisture are secondary factors in the causation of this malady. It is relatively common in hogs in rape or clover pasture.

What poisonous substance is found in young cockleburs and what are the lesions in pigs dead of cocklebur poisoning?

Xanthostrumarin, a glucoside, is the active poisonous substance in young cockleburs. The usual lesions in pigs dead of cocklebur poisoning are: varying quantities of the cocklebur plants in the stomach; congestion, and inflammation of varying intensity involving the gastric and intestinal mucosa.

What treatment is effective in porcine pulmonary strongylosis?

In pulmonary strongylosis the causative parasites are located in the bronchioles. Inhalation and intratracheal medication is of little or no value and no agent is known that, when given per os, is effective on exhalation. Therefore, control measures alone are effective. The lung parasite passes a part of its life cycle in the angle worm; consequently rotation of pens and pastures, plus sanitation, is of value. One species of angle worm lives in rotten manure; hence, swine should be excluded from old manure piles, old straw stacks, etc.

What are the lesions in swine pox?

The characteristic lesion of swine pox is the pox eruption. The successive changes of the pox are: erythema, papule, vesicle, pustule, umbilication and scab formation. Vesicles are usually quite small and umbilication is not constant.

Are swine pox and cow pox intertransmissible?

Yes, it is possible by inoculation, but occurs rarely, if ever, naturally.

Is there any relationship between infectious stomatitis in pigs and swine pox?

Hastings, of Illinois, believes there is. He has observed herds of swine that had had an attack of stomatitis and recovered and some months later were exposed to pox, but did not develop it.

What is the usual source of *Brucella suis* in swine?

The usual infection is from swine. *Br. suis* may also infect cattle.

Does *Br. suis* become generalized in swine?

The tendency of *Br. suis* to generalization is much greater than is the tendency of *Br. abortus* to affect other than the genital system. However, *Br. suis* is usually more or less localized in joints, lymph glands, mammary glands, testicles, etc.

Differentiate swine flu from pulmonary strongylosis.

Flu is a herd disease; 50% to 75% of the herd usually becoming affected within 48 hours. Flu is characterized by coughing, thumping, rapid shrinkage and high temperatures. It is essentially acute and runs its course in a few days. The mortality rate is low, often nil.

Pulmonary strongylosis has an insidious onset and is characterized by unthriftiness

* Eastern Iowa Veterinary Association, Cedar Rapids, October 22, 1936.

and paroxyms of a bronchial cough. The temperature is rarely above 103.5°F. Necropsy reveals the strongyles in the lungs, particularly in the bronchioles.

Are the petechiae in the medulla of the kidney caused by hog cholera virus?

Cholera virus injures the smaller blood vessels and capillary hemorrhage is prone to occur in various tissues in cholera affected hogs; however, petechiae in the kidney and elsewhere are common in most septicemias, and therefore are not pathognomonic of hog cholera.

Is it safe to administer anti-hog cholera serum to swine one day previous to injecting the virus?

Yes. It is safe to administer hog cholera serum not only one day, but several days prior to the administration of virus. Serum immunity should persist for 10 days, and it should therefore be safe to inject virus at any time during the serum immunity. This procedure requires handling the hogs twice. It is thought to be of value in herds in which there are enteric or pulmonary disorders. Barnard, of Belleville, Kansas, makes a practice of injecting virus several days after administering serum in herds in which there is enteritis or any disease other than cholera, and reports good results from that procedure.

Can pigs suckling cholera-immune sows contract hog cholera?

Pigs farrowed by immune sows are immune, or at least have an increased resistance to cholera at birth. This congenital resistance is lost gradually and entirely disappears by weaning time, or shortly thereafter.

Can pigs suckling cholera immune sows be given life-time immunity by the use of serum and virus?

The answer to this question is dependent upon the definition of suckling pigs. According to the experience of practitioners, the simultaneous vaccination of suckling pigs less than six or eight weeks of age, does not uniformly (either in litters of immune or non-immune sows) produce a lasting immunity. In other words, the age of the pigs is a factor that should be given consideration in routine vaccination. We do not believe it advisable to administer serum and virus to pigs that are less than eight weeks of age. The best results, in our opinion, are obtained when pigs are vaccinated two weeks or longer after weaning.

Unless cholera infection is threatening, it is our judgment that pigs less than seven weeks of age are entirely too young to treat with serum and virus, if good results are to be expected. Some experienced practitioners, however, do not agree with this.

What is the minimum dose of cholera virus necessary to produce an immunity?

It is not only the amount, but also the virulence of the virus that is important in the vaccination of swine against cholera. In general, it may be stated that not less than 2cc of virus should be used in pigs, shotes or large hogs. The use of 3cc or 4cc is good practice.

Is it possible to give too much serum, thus offsetting or preventing a virus reaction?

The exact ratio of serum and virus that produces a firm and lasting immunity is one of the unknown factors involved in the immunization of swine against cholera. The use of excess serum will not prevent a virus reaction, neither will it diminish the degree of immunity produced. The excess dosage of serum adds expense, but it is far better and more economical in the long run to use an excessive, rather than an insufficient dosage of serum.

Does 60cc of serum and 2cc of virus render less immunity to a 40-pound shote than 28cc of serum and 2cc of virus?

No, provided the serum in each case is equally potent and the virus in each case is equally virulent, and provided further the 40-pound pig is healthy when vaccinated. If the pig is suffering from enteritis, severe parasitism or other malady, his

chance of living and developing an immunity to cholera are improved by the larger dose of serum.

Is it good practice to overdose pigs with serum in routine vaccination?

Yes, because the dosage of serum indicated on the serum label is the minimum dosage. It is common knowledge that an excess dosage of serum gives better results, particularly in herds whether there exist enteric and pulmonary disorders, as well as parasitism, than does the minimum dosage. It is our opinion that the dosage of serum used in routine practice should be increased at least 25% above the minimum dosage stated in the label on the serum bottle.

Swine that apparently were immunized properly against cholera, did well on uncooked garbage for from four to 10 weeks, but subsequently died of cholera. Why?

Investigations of losses of swine fed a ration of uncooked garbage have not revealed the reason for these losses. It is generally conceded that cholera virus is more or less constant in uncooked garbage. Serum producers usually give a premium for garbage-fed hogs, because such hogs may be hyperimmunized succesfully, with a small loss.

Is it advisable to castrate cryptorchid pigs and operate on inguinal hernias at the time of vaccination?

No. During the virus reaction there is a leucopenia or reduction in the number of leucocytes in the blood; thus, during the virus reaction, the resistance of the pig is diminished, not only to suppurative processes, but also to other infections. In our opinion, it is mal-practice to castrate or to perform any other surgical operation on swine at the time of vaccinating them.

Some veterinarians state, emphatically, that pigs two or three days of age, from sows vaccinated a week previous to farrowing, will die if treated with serum and virus. Is this true?

No.

Define baby pig vaccination.

By some, pigs from the time of farrowing until they are weaned, are designated "baby pigs" and vaccination of such pigs is designated "baby pig vaccination." In my opinion, the term "baby pig vaccination" should be restricted to the vaccination of pigs less than four weeks of age.

Do *Salmonella suipestifer* and *Escherichia coli* infections impair the immunity of swine to cholera?

Immunity to cholera induced by vaccination is relative, not absolute. In my opinion, this immunity or resistance may be diminished or suspended by diseases other than cholera, and by improper feed. Thus, in an occasional hog sick from *Salmonella suipestifer* infection, it is not at all unusual to find cholera virus in the blood, even though the animal had been properly immunized and, under ordinary circumstances, would have been immune to cholera for life.

Nutritive Value of Hog Spleen

Previously[46] it had been demonstrated that the protein in beef spleen has practically the same value for maintenance and growth in young rats as the protein in hog brain and hog tongue.

In determining the nutritive value of hog spleens for maintenance and growth, and in establishing its supplemental value, the results of feeding experiments with rats indicated that beef had the highest value as a source of protein for maintenance and growth, followed closely by calf lungs and hog spleens. The proteins in calf lungs, hog spleens, cow udders, and cracklings did not seem to supplement one another materially. The protein in calf lungs, hog spleens, and beef each supplemented the protein in corn meal to a considerable degree. The proteins in a mixture of hog spleens, calf lungs, cow udders, cracklings, and corn meal appeared to supplement one another to a slight degree.

[46] Hoagland, R., and Snider, G. G. 1936. Nutritive value of the protein in calf lungs, cow udders, and hog spleens. *Jour. Agric. Res.* 53:349-354.

Bulletin Reviews

Swine Erysipelas by L. Van Es and C. B. McGrath. 47 pages. Research Bulletin No. 84. Agricultural Experiment Station, University of Nebraska. Lincoln, Nebraska. 1936.

The topics touched upon are: Historical consideratons, etiology, epizootology, symptoms, lesions, diagnosis, prophylaxis, therapy, local considerations, swine erysipelas in animals other than swine, swine erysipelas in man. The value of the bulletin is enhanced by three instructive plates, two of which are colored and an extensive bibliography.

Early developmental stages of nematodes occurring in swine. By Joseph E. Alicata. 96 pages. Technical Bulletin No. 489. United States Department of Agriculture, Washington, D. C. 1935.

This monograph describes and illustrates (30 figures) the eggs, the first, second, and third larval stages of *Gongylonema pulchrum, Ascarops strongylina, Physocephalus sexalatus, Metastrongylus salmi, M. elongatus, Choerostrongylus pudendotectus, Ascaris suum, Trichuris suis, Hyostrongylus rubidus, Oesophagostomum dentatum, Stephanurus dentatus,* and *Strongyloides ransomi.* The nomenclature of each parasite, the host relationship, geographic distribution, morphology, and bionomics of the early stages are given. A list of 143 references to the literature concludes the discussion.

Controlling Lungworms of Swine. By B. Schwartz. 5 pages. Leaflet No. 118. United States Department of Agriculture. Washington, D. C. 1936.

The bulletin briefly describes the appearance and effect of lungworms together with the mode of infestation and methods for the prevention of these parasites.

Brucella Infection in Swine. By Axel Thomson. Studies from an epizootic in Denmark 1929 to 1932. *Acta Pathologica et Microbiologica Scandinavica.* Supplement 21. 253 pages. Publisher: Levin & Munksgaard, Copenhagen. 1934.

In this monograph the author, divisional chief of the Veterinary Serum Laboratory, Copenhagen, Denmark, records his fundamental investigations into pocine brucellosis. The numerous experiments published by other research workers likewise receive proper attention. The subject is exhaustively covered: 25 illustrations, 20 tables and four plates lighten the understanding. This classical treatise forms a welcome addition to every veterinary research library.